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Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 12: Supplementary services stage 3; Sub-part 11: Call Waiting (CW)

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Foreword

This draft European Telecommunication Standard (ETS) has been produced by the Terrestrial Trunked Radio (TETRA) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

This ETS is a multi-part standard and will consist of the following parts:

Part 1: "General network design";

Part 2: "Air Interface (AI)";

Part 3: "Interworking at the Inter-System Interface (ISI)";

Part 4: "Gateways basic operation";

Part 5: "Peripheral Equipment Interface (PEI)";

Part 6: "Line connected Station (LS)";

Part 7: "Security";

Part 8: "Network management services";

Part 9: "General requirements for supplementary services";

Part 10: "Supplementary services stage 1";

Part 11: "Supplementary services stage 2";

Part 12: "Supplementary services stage 3";

Part 13: "SDL model of the Air Interface (AI)";

Part 14: "Protocol Implementation Conformance Statement (PICS) proforma specification".

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
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Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This ETS specifies the stage 3 description of the Supplementary Service Call Waiting (SS-CW) for the Terrestrial Trunked Radio (TETRA).

SS-CW permits a called user to acknowledge an incoming individual call while he is already busy. Subsequently that user shall have the choice to accept, reject or ignore that incoming call.

Man-Machine Interface (MMI) and charging principles are outside the scope of this ETS.

Supplementary service specifications are produced in three stages according to the method defined in ITU-T Recommendation I.130 [1]. The stage 1 description specifies the service from the user's point of view (see ETS 300 392-10-11 [7]). The stage 2 description identifies the functional capabilities and the information flows needed to support the service as specified in its stage 1 description (see ETS 300 392-11-11 [8]). The present stage 3 description specifies the protocols at the air interface and at the various Inter-System Interfaces (ISI) to support SS-CW.

NOTE 1: According to ITU-T Recommendation I.130 [1], the stage 3 description of any telecommunication service addresses the network implementation aspects. Consequently it comprises two steps: the specifications of all protocols at the various reference points involved in any of the service procedures (notably the service operation) are the first step of the stage 3 description, and the specifications of the functions of the corresponding network entities are its second step.

NOTE 2: The latter have not been provided since they can be derived from the specification of the functional entity actions in the stage 2 description.

This ETS is applicable to Voice plus Data individual calls; more specifically to the following entities:

- the MS/LSs of the served user and of the calling user; and
- the served user and the affected user Switching and Management Infrastructures (SwMIs) in an individual call.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative 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 ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU-T Recommendation I.130 (1993): "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[2] ETS 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

[3] ETS 300 392-3-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 1: General design".

[4] ETS 300 392-3-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 2: Additional Network Functions Individual Call (ANF-ISIIC)".

[5] ETS 300 392-3-5: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 5: Additional Network Functions Mobility Management (ANF-ISIMM)".

[6] ETS 300 392-9: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 9: General requirements for supplementary services".

[7] ETS 300 392-10-11: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 10: Supplementary services stage 1; Sub-part 11: Call waiting".

[8] ETS 300 392-11-11: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 11: Supplementary services stage 2; Sub-part 11: Call Waiting (CW)".

[9] ITU-T Recommendation Z.100: "CCITT Specification and description language (SDL)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETS, the definitions of ETS 300 392-9 [6] apply with the following modifications:

affected user: other party than the served user in an individual call.

affected user SwMI: SwMI where the affected user is currently registered. The affected user SwMI is the originating SwMI in an individual call.

served user: individual user for whom SS-CW supplementary service has been subscribed. When SS-CW has been activated for him, that user can thus successfully invoke the supplementary service for a new incoming individual call while he is already busy.

served user SwMI: SwMI where the served user is currently registered. In an individual call, the served user SwMI is the terminating SwMI.

timer T2: measures the waiting time for the offered call from user C to be either accepted or cleared by the served user B after SS-CW has been invoked. This timer is a network basic call timer. It corresponds to the basic call timer T304 on the called user side (see *(new version of)* clause 14 of ETS 300 392-2 [2]).

3.2 Abbreviations

For the purposes of this ETS, the following general abbreviations apply:

ANF-ISIGC	Additional Network Feature - Inter-System Interface Group Call
ANF-ISIIC	Additional Network Feature - Inter-System Interface Individual Call
ANF-ISIMM	Additional Network Feature - Inter-System Interface Mobility Management
ANF-ISISS	Additional Network Feature - Inter-System Interface Supplementary Service
CW	Call waiting
ISI	Inter-System Interface
LS	Line Station
MS	Mobile Station
PDU	Protocol Data Unit
ROSE	Remote Operation Service Element
SDL	Specification Description Language
SS	Supplementary Service

NOTE: The abbreviation SS is only used when referring to a specific supplementary service (e.g. SS-CW).

SwMI	Switching and Management Infrastructure

4 SS-CW service description

4.1 General

SS-CW permits a called user to acknowledge an incoming individual call while he is already busy. That call shall then be qualified as a waiting call. Subsequently that user shall have the choice to accept, reject or ignore the waiting call.

This clause describes the SS-CW services offered by the Circuit Mode Control Entity (CMCE) at the Supplementary Services service access point (TNSS-SAP) of the TETRA voice plus data layer 3 service boundary in a TETRA Mobile Station (MS) or TETRA Line Station (LS). The SS-CW service access point is used in conformance testing as a normative boundary in MSs and LSs.

NOTE: As this document deals only with SS-CW, all the service primitives has been shown without a TNSS-CW- prefix e.g. the TNSS-CW-INVOKE request is shortened into an INVOKE request.

4.2 SS-CW services offered over the TNSS-SAP

NOTE: As man-machine interface or user applications are outside the scope of this standard service primitives are used to define information exchange to and from the standardized part of the MS/LS. Those primitives may be only indirectly accessible.

The SS-CW service primitives at the served user MS/LS TNSS-SAP shall be:

- ACTIVATE request;
- ACTIVATE ACK indication;
- DEACTIVATE request;
- DEACTIVATE ACK indication;
- INVOKE request;
- INVOCATION FAILURE indication.

The SS-CW service primitives for the affected user at the MS/LS TNSS-SAP shall be:

- INFORM 1 indication;
- INFORM 2 indication.

4.2.1 ACTIVATE request

The ACTIVATE request primitive shall be sent over the served user TNSS-SAP by the served user application to the MS/LS CMCE to request SS-CW activation for that user.

The ACTIVATE request primitive may contain the SS-CW parameter given in table 1.

Table 1: Parameter for the primitive ACTIVATE request

Parameter	Request
Access priority	O

4.2.2 ACTIVATE ACK indication

The ACTIVATE ACK indication primitive shall be sent over the served user TNSS-SAP by the MS/LS CMCE to the user application to inform it about the result of a previous ACTIVATE request.

The ACTIVATE ACK indication primitive shall contain the SS-CW parameters listed in table 2.

Table 2: Parameters for the primitive ACTIVATE ACK indication

Parameter	Indication
Activation result	M
Activation failure cause	C (note)
NOTE: Conditional on the activation result being negative.	

4.2.3 DEACTIVATE request

The DEACTIVATE request primitive shall be sent over the served user TNSS-SAP by the served user application to the MS/LS CMCE to request SS-CW deactivation for that user.

The DEACTIVATE request primitive may contain the SS-CW parameter given in table 3.

Table 3: Parameter for the primitive DEACTIVATE request

Parameter	Request
Access priority	O

4.2.4 DEACTIVATE ACK indication

The DEACTIVATE ACK indication primitive shall be sent over the served user TNSS-SAP by the MS/LS CMCE to the user application to inform it about the result of a previous DEACTIVATE request.

The DEACTIVATE ACK indication primitive shall contain the SS-CW parameters listed in table 4.

Table 4: Parameters for the primitive DEACTIVATE ACK indication

Parameter	Indication
Deactivation result	M
Deactivation failure cause	C (note)
NOTE: Conditional on the deactivation result being negative.	

4.2.5 INFORM 1 indication

The INFORM 1 indication primitive may be sent over the affected user TNSS-SAP by the MS/LS CMCE to the user application to inform it that the called user has (just) been invoked SS-CW for the call from the affected user.

There are no parameters in the INFORM 1 indication primitive.

4.2.6 INFORM 2 indication

The INFORM 2 indication primitive may be sent over the affected user TNSS-SAP by the MS/LS CMCE to the user application to inform it that its call for which SS-CW was previously invoked has (just) been cleared because the served user has moved into a new area: either

- in the same SwMI (i.e. the served user has roamed) but that SwMI does not support the SS-CW location change procedure; or

- in a new SwMI (i.e. the served user has migrated) which does not support: either

    - the SS-CW migration procedure; or
    - SS-CW itself.

There are no parameters in the INFORM 2 indication primitive.

4.2.7 INVOKE request

The INVOKE request primitive shall be sent over the served user TNSS-SAP by the user application to the MS/LS CMCE to invoke SS-CW.

There are no parameters in the INVOKE request primitive.

4.2.8 INVOCATION FAILURE indication

The INVOCATION FAILURE indication primitive shall be sent over the served user TNSS-SAP by the MS/LS CMCE to the user application to inform it about the failure of a previous INVOKE request.

The INVOCATION FAILURE indication primitive shall contain the SS-CW parameters listed in table 5.

Table 5: Parameter for the primitive INVOCATION FAILURE indication

Parameters	Indication
Invocation failure cause	M

4.3 Parameter description

Access priority:

- low priority;
- high priority;
- emergency priority.

The default value for that parameter shall be low priority. The value emergency priority should not be used for that parameter in any primitive.

Activation result:

- successful request;
- unsuccessful request.

Activation failure cause:

- rejected for any reason;
- supplementary service not subscribed to;
- not supported;
- protocol problem.

The last three failure causes are sent by the infrastructure to inform the served user who has requested SS-CW activation that his request has failed for one of the following reasons:

- for the failure cause not subscribed: SS-CW has not been subscribed to for that user;
- for the failure cause not supported: the home SwMI of that user does not support SS-CW, else the SwMI where he is currently registered has not been able to pass his request to his home SwMI;
- for the failure cause protocol problem: e.g. there has been an erroneous encoding of the activation request, or transmission.

NOTE 1: Each of the three above failure causes being mutually exclusive of the two others, there is no need to repeat the parameter activation failure cause in the ACTIVATE ACK indication primitive.

Deactivation result:

- successful request;
- unsuccessful request.

Deactivation failure cause:

- rejected for any reason;
- not supported;
- protocol problem.

The last two failure causes are sent by the infrastructure to inform the served user who has requested SS-CW activation that his request has failed for one of the following reasons:

- for the failure cause not supported: the home SwMI of that user does not support SS-CW, else the SwMI where he is currently registered has not been able to pass his request to his home SwMI;
- for the failure cause protocol problem: e.g. there has been an erroneous encoding of the activation request, or transmission.

NOTE 2: The two above failure causes being mutually exclusive of each other, there is no need to repeat the parameter activation failure cause in the DEACTIVATE ACK indication primitive.

NOTE 3: Contrary to the ACTIVATE request primitive, there is no need to indicate to the user who has requested SS-CW deactivation that SS-CW has not been subscribed to for that user, since SS-CW will never be activated for that user in such a case. Any request for deactivation should then be considered as erroneous.

Invocation failure cause:

- rejected for any reason;
- not subscribed;
- subscribed but not activated;
- maximum number of waiting calls already reached;
- not supported;
- protocol problem.

Those failure causes are sent by the infrastructure (more precisely, by the terminating SwMI) to inform the served user who has invoked SS-CW that his invocation has failed for one of the following reasons:

- for the failure cause not subscribed: SS-CW has not been subscribed to for that user;
- for the failure cause subscribed but not activated: SS-CW has been subscribed to for that user, but not activated;
- for the failure cause maximum number of waiting calls already reached: SS-CW cannot be invoked because there are too many calls still in the call waiting state (for the served user);
- for the failure cause not supported: the terminating SwMI does not support SS-CW;
- for the failure cause protocol problem: e.g. the invocation request has been placed outside of a call, or there has been an erroneous encoding of the invocation request, or transmission.

NOTE 4: Each of the four above failure causes being mutually exclusive of the three others, there is no need to repeat the parameter invocation failure cause in the INVOCATION FAILURE indication primitive.

5 Signalling protocol for the support of SS-CW

5.1 SS-CW operational requirements

5.1.1 Served user MS/LS

The served user MS/LS shall comply with the requirements in clause 14 of ETS 300 392-2 [2] which apply to the tele- and bearer-services which it supports and which are invoked as individual calls. It shall also comply with the call related requirements in clauses 7, 8 and 11 of ETS 300 392-9 [6] which apply to the INVOCATION FAILURE and INVOKE PDUs (see subclauses 5.2.1.5 and 5.2.1.6 for the definition of those PDUs).

If it supports the following optional procedures, the served user MS/LS shall comply with the corresponding call unrelated requirements in clauses 7, 8 and 11 of ETS 300 392-9 [6]:

- for the (SS-CW) location change procedure, those which apply for sending the LOCATION CHANGE PDU and receiving the LOCATION CHANGE ACK PDU (see subclauses 5.2.1.7 and 5.2.1.8 for the definition of those PDUs).

- for the activation procedure, those which apply to the ACTIVATE, ACTIVATE ACK, DEACTIVATE and DEACTIVATE ACK PDUs (see subclauses 5.2.1.1 to 5.2.1.4 for the definition of those PDUs).

5.1.2 Served user SwMI

That SwMI shall support as served user SwMI the served user MS/LS complying with the requirements for individual calls set in subclause 5.1.1. It shall also comply with the call related requirements in clauses 7 to 11 of ETS 300 392-9 [6] which apply to the INVOCATION FAILURE and INVOKE PDUs (see subclauses 5.2.1.5 and 5.2.1.6 for the definition of those PDUs) and to the sending of notification to the affected user.

If the call is over the ISI, the served user SwMI shall comply with the corresponding ISI requirements for individual calls, set in ETS 300 392-3-2 [4]. In addition, if it supports the optional SS-CW migration procedure, the served user SwMI shall comply with the call related requirements in clauses 8 to 11 of ETS 300 392-9 [6] for sending the MIGRATION PDU and receiving the MIGRATION ACK PDU (see subclauses 5.2.1.9 and 5.2.1.10 for the definition of those PDUs).

If it supports the following optional procedures, the served user SwMI shall comply with the corresponding call unrelated requirements in clauses 7 to 11 of ETS 300 392-9 [6]:

- for the (SS-CW) location change procedure, those which apply for receiving the LOCATION CHANGE PDU and sending the LOCATION CHANGE ACK PDU (see subclauses 5.2.1.7 and 5.2.1.8 for the definition of those PDUs);

- for the activation procedure, those which apply to the ACTIVATE, ACTIVATE ACK, DEACTIVATE and DEACTIVATE ACK PDUs (see subclauses 5.2.1.1 to 5.2.1.4 for the definition of those PDUs).

5.1.3 New served user SwMI

That SwMI shall support the call restoration procedure for the migrating served user MS/LS as set in subclause 6.5.2.3 of ETS 300 392-3-2 [4] (for individual calls).

It shall also comply with the call related requirements in clauses 8 to 11 of ETS 300 392-9 [6] for receiving the MIGRATION PDU and sending the MIGRATION ACK PDU (see subclauses 5.2.1.9 and 5.2.1.10 for the definitions of those PDUs).

Since once the migration procedure is complete, that SwMI becomes the served user SwMI, it shall also comply with the operational requirements set in subclause 5.1.2.

5.1.4 Affected user MS/LS

The affected user MS/LS shall comply with the requirements in clause 14 of ETS 300 392-2 [2] which apply to the tele- and bearer services which it supports and which are invoked as individual calls. In addition, it shall comply with subclause 7.2.2 of ETS 300 392-9 [6] (for receiving notifications).

5.1.5 Affected user SwMI

That SwMI shall support as affected user SwMI the affected user MS/LS complying with the requirements for individual calls set in subclause 5.1.4.

If the call is over the ISI, i.e. the affected user SwMI is different from the served user SwMI, the affected user SwMI shall comply with:

- the corresponding ISI requirements for individual calls, set in ETS 300 392-3-2 [4]; and

- the call related requirements in clauses 7, 9, 10 and 11 of ETS 300 392-9 [6] which apply to the sending of notification to the affected user.

5.1.6 Served user home SwMI

If it supports the activation procedure, the served user home SwMI shall comply with the call unrelated requirements in clauses 7 to 11 of ETS 300 392-9 [6] which apply to the ACTIVATE, ACTIVATE ACK, DEACTIVATE and DEACTIVATE ACK PDUs (see subclauses 5.2.1.1 to 5.2.1.4 for the definition of those PDUs).

5.2 Coding requirements

The information contained in the following description tables corresponds to the following keys:

Length: length of the information element or sub-element in bits
Type: element type (1,2,3) described in subclause 14.7 of ETS 300 392-2 [2]
C/O/M: conditional/optional/mandatory information in the PDU
Remark: comment or reference to note(s)

5.2.1 SS-CW PDUs

5.2.1.1 ACTIVATE PDU

ACTIVATE PDU may be sent by the served user MS/LS to the served user home SwMI.

The served user expects one ACTIVATE PDU as a response.

ACTIVATE PDU shall contain the SS-CW information elements listed in table 6.

Table 6: ACTIVATE PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	ACTIVATE

5.2.1.2 ACTIVATE ACK PDU

ACTIVATE ACK PDU may be sent by the served user SwMI to the served user MS/LS as a response to a previous activation request (sent by the ACTIVATE PDU).

ACTIVATE ACK PDU shall contain the SS-CW information elements listed in table 7.

Table 7: ACTIVATE ACK PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	ACTIVATE ACK
Activation/deactivation result	1	1	M	
Activation/deactivation failure cause	1	1	C	note 1
Activation state	1	1	C	note 2
NOTE 1: Shall be conditional on the value of the information element activation/deactivation result being equal to 0.				
NOTE 2: Shall be conditional on the value of the information element activation/deactivation result being equal to 1.				

5.2.1.3 DEACTIVATE PDU

DEACTIVATE PDU may be sent by the served user MS/LS to the served user home SwMI.

The served user expects one DEACTIVATE PDU as a response.

DEACTIVATE PDU shall contain the SS-CW information elements listed in table 8.

Table 8: DEACTIVATE PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	DEACTIVATE

5.2.1.4 DEACTIVATE ACK PDU

DEACTIVATE ACK PDU may be sent by the served user SwMI to the served user MS/LS as a response to a previous activation request (sent by the DEACTIVATE PDU).

DEACTIVATE ACK PDU shall contain the SS-CW information elements listed in table 9.

Table 9: DEACTIVATE ACK PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	DEACTIVATE ACK
Activation/deactivation result	1	1	M	
Activation/deactivation failure cause	1	1	C	note 1
Activation state	1	1	C	note 2
NOTE 1: Shall be conditional on the value of the information element activation/deactivation result being equal to 0.				
NOTE 2: Shall be conditional on the value of the information element activation/deactivation result being equal to 1.				

5.2.1.5 INVOCATION FAILURE PDU

INVOCATION FAILURE PDU is sent by the served user SwMI to the served user MS/LS in case of failure of a previous invocation (sent by the INVOKE PDU).

INVOCATION FAILURE PDU shall contain the SS-CW information elements listed in table 10.

Table 10: INVOCATION FAILURE PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	INVOCATION FAILURE
Invocation failure cause	2	1	M	

5.2.1.6 INVOKE PDU

INVOKE PDU is sent by the served user MS/LS to the served user SwMI to invoke SS-CW for an incoming individual call.

INVOKE PDU shall contain the SS-CW information elements listed in table 11.

Table 11: INVOKE PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	INVOKE

5.2.1.7 LOCATION CHANGE PDU

LOCATION CHANGE PDU is sent by the served user MS every time the served user updates his registration with one or more calls waiting. In the case of roaming (i.e. location change within the same SwMI) it is sent to the served user SwMI; in the case of migration (i.e. registration in a new SwMI), it is sent to the new served user SwMI.

LOCATION CHANGE PDU shall contain the SS-CW information elements listed in table 12.

Table 12: LOCATION CHANGE PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	LOCATION CHANGE
Number of waiting calls	3	1	M	

5.2.1.8 LOCATION CHANGE ACK PDU

LOCATION CHANGE ACK PDU may be sent by the served user SwMI or the new served user SwMI to the served user MS as a response to the LOCATION CHANGE ACK PDU sent previously (when the served user roams or migrates).

NOTE: The support of the location change procedure being optional, the MS may receive the reject SS PDU defined in subclause 8.2 of ETS 300 392-9 [6] instead of the LOCATION CHANGE ACK PDU.

LOCATION CHANGE ACK PDU shall contain the SS-CW information elements listed in table 13.

Table 13: LOCATION CHANGE ACK PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	LOCATION CHANGE ACK
Waiting call change	2	1	M	
Number of call identifiers changed	3	1	C	note 1
Old call identifier	14	1	C	note 2
New call identifier	14	1	C	note 2
Number of waiting calls lost	3	1	C	note 3
Old call identifier	14	1	C	note 4

NOTE 1: Shall be conditional on the value of the information element waiting call change indicating that one or more call identifiers of waiting calls have changed.
NOTE 2: Shall be repeated as a set as many times as the value of the information element number of call identifiers changed.
NOTE 3: Shall be conditional on the value of the information element waiting call change indicating that one or more waiting calls have been lost during the location change procedure.
NOTE 4: Shall be repeated as many times as the value of the information element number of waiting calls lost.

In the case of migration, the sum of the number of call identifiers changed and of the number of waiting calls lost in the LOCATION CHANGE ACK PDU may be lower than the value of the information element number of waiting calls in the corresponding LOCATION CHANGE PDU: e.g. in the case where the new served user SwMI sends the LOCATION CHANGE ACK PDU before the migration procedures have been completed for each waiting call.

5.2.1.9 MIGRATION PDU

MIGRATION PDU may be sent by the old served user SwMI to the new served user SwMI, to inform it that the connection being established by ANF-ISIIC between both SwMIs to prepare call restoration is for a call still in the call waiting state for the migrating served user.

MIGRATION PDU shall contain the SS-CW information elements listed in table 14.

Table 14: MIGRATION PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	MIGRATION
Number of waiting calls	3	1	M	
NOTE: In the case of migration, there is one migration procedure per waiting call (see subclause 5.4.3). The information element number of waiting calls is then necessary for the new served SwMI to know how many migration procedures it may expect to run.				

5.2.1.10 MIGRATION ACK PDU

MIGRATION ACK PDU may be sent by the new served user SwMI to the (old) served user SwMI, to acknowledge the reception of the previous MIGRATION PDU.

MIGRATION ACK PDU shall contain the SS-CW information elements listed in table 15.

Table 15: MIGRATION ACK PDU contents

Information element	Length	Type	C/O/M	Remark
SS-type	6	1	M	Defined in ETS 300 392-9 [6]
CW PDU type	5	1	M	MIGRATION ACK

5.2.2 TETRA PDU information element and sub-element coding

5.2.2.1 Activation/deactivation failure cause

The information element activation/deactivation failure cause shall give the reason why the value of the information element activation result is equal to 0 in the ACTIVATE ACK PDU or in the DEACTIVATE ACK PDU. It shall be encoded as defined in table 16.

Table 16: Activation/deactivation failure cause information element contents

Information element	Length	Value	Remark
Activation/deactivation failure cause	1	0	Rejected for any reason
		1	Supplementary service not subscribed for user

5.2.2.2 Activation/deactivation result

The information element activation/deactivation result shall indicate whether the previous activation request has been successful or unsuccessful as defined in table 17.

Table 17: Activation/deactivation result information element contents

Information element	Length	Value	Remark
Activation/deactivation result	1	0	Activation/deactivation request unsuccessful
		1	Activation/deactivation request successful

5.2.2.3 Activation state

The information element activation state shall indicate whether SS-CW is currently activated or not for the served user as defined in table 18.

Table 18: Activation state information element contents

Information element	Length	Value	Remark
Activation state	1	0	SS-CW not activated for served user
		1	SS-CW activated for served user

5.2.2.4 CW PDU type

The information element CW PDU type shall indicate the type of the CW PDU, as defined in table 19.

Table 19: CW PDU type information element contents

Information element	Length	Value	Remark
CW PDU type	5	00000_2	See ETS 300 392-9 [6]
		00001_2	See ETS 300 392-9 [6]
		00010_2	See ETS 300 392-9 [6]
		00011_2	See ETS 300 392-9 [6]
		00100_2	See ETS 300 392-9 [6]
		00101_2	ACTIVATE
		00110_2	ACTIVATE ACK
		00111_2	DEACTIVATE
		01000_2	DEACTIVATE ACK
		01001_2	INVOCATION FAILURE
		01010_2	INVOKE
		01011_2	INVOKE ACK
		01100_2	LOCATION CHANGE
		01101_2	LOCATION CHANGE ACK
		01110_2	MIGRATION
		01111_2	MIGRATION ACK
		$> 01111_2$	Reserved

5.2.2.5 Invocation failure cause

The information element invocation failure cause shall give the reason why the INVOCATION FAILURE PDU is sent. It shall be encoded as defined in table 20.

Table 20: Invocation failure cause information element contents

Information element	Length	Value	Remark
Invocation failure cause	2	00_2	Rejected for any reason
		01_2	Supplementary service not subscribed for user
		10_2	Supplementary service not activated for user (note)
		11_2	Maximum number of waiting calls already reached
NOTE: That value may only be used if the supplementary service has been subscribed			

5.2.2.6 New/old call identifier

The information element old call identifier shall give the previous reference of the call in the waiting call state in the case where that reference has changed or where that call has been lost during the location change procedure. If the call identifier has changed, the information element new call identifier shall then give the new reference of the call. Both information elements shall be encoded as defined in table 91 of ETS 300 392-2 [2] (for the information element call identifier).

5.2.2.7 Number of call identifiers changed/ number of waiting calls lost

The information element number of call identifiers changed shall indicate the number of calls still in the waiting call state for which the call identifiers have changed and the new call identifiers are given as repeated information elements in the same (LOCATION ACK) PDU.

The information element number of waiting calls lost shall indicate the number of calls lost during the location change procedure (see subclause 5.2.2.9) for which the call identifiers are given as repeated information elements in the same (LOCATION ACK) PDU.

Both information elements shall be encoded as the information element number of waiting calls (see table 21).

5.2.2.8 Number of waiting calls

The information element number of waiting calls shall indicate how many calls are in the waiting call state for the served user at the time it is sent. It shall be encoded as defined in table 21.

Table 21: Number of waiting calls information element contents

Information element	Length	Value	Remark
Number of waiting calls	3	000_2	Reserved
		001_2	One call in the call waiting state
		$>001_2$	N calls in the call waiting state, N being the value of the information element

5.2.2.9 Waiting call change

The information element waiting call change shall indicate whether one or more waiting call identifiers have changed in the location change procedure and/or whether one or more waiting calls have been lost during the location change procedure (i.e. because the location change procedure failed, e.g. by lack of resources internal to the served user SwMI, or the call has been cleared on user C side, else because an ISI connection used for the waiting call has been pre-empted).

It shall be encoded in a bit-map manner as defined in table 22.

Table 22: Waiting call change information element contents

Information element	Length	Value (note)	Remark
Waiting call change	2	00_2	No change occurred
		$x1_2$	One or more waiting call identifiers changed
		$1x_2$	One or more waiting calls lost
NOTE: The letter x in the values in that column stands for 0 or 1 indifferently.			

5.2.2.10 CW-ISI-PROFILE

CW-ISI-PROFILE is actually an ANF-ISIMM information sub-element, part of the information element SS-migration profile (original) sent for SS-CW by the home SwMI to the served user SwMI when that user migrates or when SS-CW activation is changed, in the ANF-ISIMM PDU SS-PROFILE UPDATE (see ETS 300 392-3-5 [5]).

CW-ISI-PROFILE shall simply be the SS-CW information element activation state as shown in table 23.

Table 23: CW-ISI-PROFILE information sub-element contents

Information sub-element	Length	Type	C/O/M	Remark
Activation state	1	1	M	see table 18
NOTE: There is no need to specify the identity of the user to whom the profile information sub-element specified in the above table applies since the ANF-ISIMM SS-PROFILE UPDATE PDU which carries that information sub-element already includes that identity, at least implicitly.				

5.2.3 Additional coding requirements over the ISI

Except for the SS-CW MIGRATION and MIGRATION ACK PDUs (see below), the following shall apply for the PSS1 facility information element carrying an APDU of the ROSE operation used by ANF-ISISS for SS-CW PDUs:

- both the source Entity and destinationEntity data elements in the Network Facility Extension of this PSS1 facility information element shall contain the value endPINX;

- no interpretation APDU shall be included in this PSS1 facility information element.

If sent by the old served user SwMI, the SS-CW MIGRATION PDU shall be included as an APDU of the ROSE operation used by ANF-ISISS in the same PSS1 facility information element as that carrying the ANF-ISIIC-CALL RESTORE PREPARE PDU, else the ANF-ISIIC-END CALL RESTORE PREPARE PDU or the ANF-ISIIC-PATH RESTORE PREPARE PDU (as a different APDU of the same ROSE operation - used by ANF-ISIIC), itself sent by the old served SwMI to the new served SwMI to prepare call restoration (as if the individual call was ongoing, and not in the call waiting state for the migrating served user).

NOTE 1: It may thus happen that the destinationEntity data element in the Network Facility Extension of this PSS1 facility information element contain a value different from endPINX (in the case of call restoration with loop or trombone avoidance - e.g. individual call initially established by forward switching through the called user home SwMI to a user who has migrated and that (called) user migrates back, into that SwMI).

If sent back by the new served user SwMI, the SS-CW MIGRATION ACK PDU shall be included as an APDU of the ROSE operation used by ANF-ISISS in the same PSS1 facility information element as that carrying the ANF-ISIIC-CALL RESTORE PREPARED PDU (as a different APDU of the same ROSE operation - used by ANF-ISIIC), sent by the new served SwMI to the old served SwMI to acknowledge one of the following ANF-ISIIC PDUs sent previously for the (individual) call in the call waiting state:

- the ANF-ISIIC-CALL RESTORE PREPARE PDU; else

- the ANF-ISIIC-END CALL RESTORE PREPARE PDU or the ANF-ISIIC-PATH CALL RESTORE PREPARE PDU.

NOTE 2: As provided in subclause 5.4.3, the SS-CW MIGRATION ACK PDU is not sent back:
- when the new served user SwMI does not support the SS-CW migration procedure;
- when the ANF-ISIIC-CALL RESTORE PREPARED PDU is not sent to the old served user SwMI (the ANF-ISIIC-CONNECT PDU or the ANF-ISIIC-PATH CLEARING PDU being sent instead).

5.3 SS-CW state definition

5.3.1 States at the served user MS/LS

Two types of state definitions have been identified:

- one for SS-CW invocation and operation;

- the other for SS-CW activation.

5.3.1.1 States for invocation and operation

The following conceptual states have been identified in the served user MS/LS for writing the procedures for SS-CW invocation and operation:

- idle;

- call_waiting;

- location_change.

5.3.1.2 State for activation

Only one conceptual state has been identified in the served user MS/LS for writing the procedures for SS-CW activation: idle.

5.3.2 States at the served user SwMI

Two types of state definitions have been identified:

- one for SS-CW invocation and operation;

- the other for SS-CW activation.

5.3.2.1 States for invocation and operation

The following conceptual states have been identified in the served user SwMI for writing the procedures for SS-CW invocation and operation:

- idle;
- call_waiting;
- migration;
- waiting_for_call_acceptance;
- waiting_for_call_clearing.

5.3.2.2 State for activation

Only one conceptual state has been identified in the served user SwMI for writing the procedures for SS-CW activation: idle.

5.3.3 States at the new served user SwMI

The following conceptual states have been identified in the new served user SwMI for writing the SS-CW procedures (i.e. for operation):

- idle;
- new_call_identifiers_requested.

NOTE: After the SS-CW migration procedure has been completed, the new served user SwMI ceases to exist because: either
- it has become the served user SwMI, if the SS-CW migration procedure has been successful; or
- the waiting call is cleared, if the SS-CW migration procedure has been unsuccessful.

5.3.4 State at the affected user MS/LS

Only one conceptual state has been identified in the affected user MS/LS for writing the SS-CW procedures (i.e. for operation): idle.

5.3.5 State at the affected user SwMI

Only one conceptual state has been identified in the affected user SwMI for writing the SS-CW procedures (i.e. for operation): idle.

5.3.6 States at the served user home SwMI

Only one conceptual state has been identified in the served user home SwMI for writing the SS-CW procedures (i.e. for activation): idle.

5.4 SS-CW signalling procedures

Examples of message sequences are shown in annex A.

5.4.1 Actions at the served user MS/LS

The SDL representation of procedures at the calling user MS/LS is shown in clause B.1 of annex B.

5.4.1.1 Normal procedures

5.4.1.1.1 Invocation and operation

When the served user has invoked SS-CW during an individual call, the served user MS/LS shall send the U-ALERT PDU (see table 77 of ETS 300 392-2 [2]) including the INVOKE PDU, defined in table 11.

NOTE 1: Since node actions are not to be described as part of the protocol, it should be reminded that, according to ETS 300 392-11-11 [8], on SS-CW stage 2 description, except for special applications, once the served user has invoked SS-CW, if the initial value of his MS/LS basic call timer T304 (see clause 14 of ETS 300 392-2 [2]) is less than 30 seconds, that MS/LS should extend it at least to 30 seconds.

When the served user roams (i.e. changes registered area within the same SwMI) or migrates (registers in a new SwMI) with one or more calls in the call waiting state, even he does not have an active call to restore, his MS shall give the value corresponding to "call restoration roaming location updating" or "call restoration migrating location updating" respectively to the location update type information element (see table 197 of ETS 300 392-2 [2]) in the corresponding registration PDU: MM U-LOCATION UPDATE PDU (see table 161 of ETS 300 392-2 [2]). If the served user wants to keep his waiting calls "alive", his MS shall send the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the LOCATION CHANGE PDU, defined in table 12.

In addition, in the case where the served user roams without having an active call to restore, his MS shall send that U-FACILITY PDU including the LOCATION CHANGE PDU mentioned above in the MLE U-RESTORE PDU (see table 228 of ETS 300 392-2 [2]).

After the served user MS has sent the LOCATION CHANGE PDU, it may then receive the D-FACILITY PDU (see subclause 7.3 of ETS 300 392-9 [6]) including the LOCATION CHANGE ACK PDU, defined in table 13.

To accept a call previously put in the call waiting state, the served user MS/LS shall send the U-CONNECT PDU (see table 79 of ETS 300 392-2 [2]). The value of the information element call identifier in that PDU shall be the same as in the U-ALERT PDU sent previously for the call (i.e. including the INVOKE PDU), unless that call identifier has been updated by one or more LOCATION CHANGE ACK PDUs. In the latter case, the served user MS/LS shall use the call identifier latest update received.

Since the call identifier change will be systematic in case of migration, if the served user decides to accept the waiting call immediately after having registered in the new served user SwMI, its MS/LS shall delay the sending of the corresponding U-CONNECT PDU until it has received the LOCATION CHANGE ACK PDU (from the new served user SwMI).

To clear a waiting call, the served user MS/LS shall use the basic call procedure, as defined in subclause 14.5.1.3.1 of ETS 300 392-2 [2].

NOTE 2: This means that the served user MS/LS may send the U-DISCONNECT PDU with the call identifier of the call in the call waiting state (i.e. there is no need for that MS/LS to have previously accepted that call).

5.4.1.1.2 Activation/deactivation

The served user MS/LS may support the activation/deactivation procedure. That procedure consists in:

- sending to the served user SwMI the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the ACTIVATE PDU or the DEACTIVATE PDU, defined in tables 6 and 8 respectively. Those ACTIVATE PDU and DEACTIVATE PDUs shall be addressed to the served user home SwMI (in giving to the routeing information element in the U-FACILITY PDUs which carry them at the air interface the value corresponding to home SwMI of the sending MS);

- then waiting for receiving the D-FACILITY PDU (see subclause 7.3 of ETS 300 392-9 [6]) including the ACTIVATE ACK PDU, defined in table 7, if it has sent the ACTIVATE PDU, or the DEACTIVATE ACK PDU if it has sent the DEACTIVATE PDU, defined in table 9.

5.4.1.2 Exceptional procedures

5.4.1.2.1 Invocation

The following shall apply when the user has invoked SS-CW and when that invocation fails for one of the three following reasons:

- the supplementary service has not been subscribed for him;
- the supplementary service has been subscribed for him but has not been activated;
- the maximum number of waiting calls has already been reached.

The served user MS/LS shall receive the D-INFO PDU or the D-RELEASE PDU (defined in tables 67 and 68 respectively of ETS 300 392-2 [2]) including the INVOCATION FAILURE PDU, defined in table 10. The value of the information element invocation failure cause (see table 20) in that PDU shall indicate which of the above reasons applies.

NOTE 1: Obviously the three failure reasons mentioned above are mutually exclusive. Thus the case where more than one value of the information element invocation failure cause would be needed is excluded.

NOTE 2: If SS-CW invocation by a user fails because the SwMI where that user is registered does not support SS-CW, that user will be informed about it according to the procedure defined in subclause 11.2.1 of ETS 300 392-2 [2].

5.4.1.2.2 Operation

No specific procedures apply for the served user MS/LS.

NOTE 1: The basic call procedure applies if the served user MS/LS has sent the U-CONNECT PDU (see table 79 of ETS 300 392-2 [2]) and that request fails (e.g. the call identifier used in the U-CONNECT PDU either does not exist or does not correspond to a call still waiting for the served user).

NOTE 2: If the served user changes location with one or more calls in the call waiting state and if his MS receives a generic reject SS PDU after it has sent the LOCATION CHANGE PDU (see subclause 5.4.1.1.1), according to the procedure defined in subclause 11.2.1 of ETS 300 392-9 [6], that MS will identify that:
- in case of roaming, i.e. within the same served user SwMI, that SwMI does not support the location change procedure; or
- in case of migration, i.e. into a new served user SwMI, that SwMI does not support: either
  - the SS-CW migration procedure; or
  - SS-CW itself.

The served user MS will then consider that the call has been cleared (and send the TNCC-RELEASE indication to the served user application).

5.4.1.2.3 Activation/deactivation

If the served user MS/LS has sent the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the ACTIVATE PDU and if the requested SS-CW activation fails because that supplementary service has not been subscribed to for that user, it shall receive the D-FACILITY PDU (see subclause 7.3 of ETS 300 392-9 [6]) including the ACTIVATE ACK PDU, defined in table 7, including the corresponding information element values (see tables 17 and 16).

Similarly, if the served user MS/LS has sent the U-FACILITY PDU including the DEACTIVATE PDU and if SS-CW has not been subscribed to for that user, it shall receive the D-FACILITY PDU including the DEACTIVATE ACK PDU, defined in table 9, with the same information element values as in the ACTIVATE PDU sent in case of activation failure.

NOTE 1: If a SS-CW activation or deactivation request by a served user fails because his home SwMI does not support that (optional) procedure, that user will be informed about it according to the procedure defined in subclause 11.2.1 of ETS 300 392-2 [2].

NOTE 2: Since terminal equipment actions are not to be described as part of the protocol, it should be reminded that, according to ETS 300 392-11-11 [8], on SS-CW stage 2 description, in the case where the home SwMI does not support the activation/deactivation procedure, the served user will consider that SS-CW has been activated.

5.4.2 Actions at the served user SwMI

The SDL representation of procedures at the served user SwMI is shown in clause B.2 of annex B.

5.4.2.1 Normal procedures

5.4.2.1.1 Accepting SS-CW invocation

When the served user SwMI has received the U-ALERT PDU (see table 77 of ETS 300 392-2 [2]) including the INVOKE PDU, defined in table 11, it shall identify that the served user has invoked SS-CW.

NOTE 1: Since node actions are not to be described as part of the protocol, it should be reminded that, according to ETS 300 392-11-11 [8], on SS-CW stage 2 description:
- when the terminating SwMI receives a set-up request for a new individual call for a called user, it should check whether the two following conditions are met:
  - that user is already busy (at least to its knowledge); and
  - the maximum number of additional calls to that user has not been reached.
- if this is the case, the terminating SwMI should check whether SS-CW has been subscribed for that user and is activated:
  - if yes, it will offer that new call to that user;
  - if SS-CW has been subscribed to for that user and is deactivated, it should not offer that new call to that user;
  - if SS-CW has not been subscribed to for that user, it may or may not offer that new call to that user (i.e. what the terminating SwMI does is an implementation matter).
- when the served user SwMI has received the U-ALERT PDU (see table 77 of ETS 300 392-2 [2]) including the INVOKE PDU from the MS/LS of a user, that SwMI will first check whether SS-CW has been subscribed for that user and is activated.

The case where the result of that check is negative is addressed in subclause 5.4.2.2. If that result is positive, the call will now be in the call waiting state. Except for special applications, if the initial value of timer T2 (see clause 3 for the definition of that timer) is less than 30 seconds, the served user SwMI should extend it at least to 30 seconds.

If the served user SwMI accepts the SS-CW invocation:

- if the served user SwMI does not coincide with the affected user SwMI (i.e. the call is over the ISI), the served user SwMI shall send in the PSS1 ALERTING message the ANF-ISIIC-ALERTING PDU (see table 32 of ETS 300 392-3-2 [4]) including the notification indicator information element with the value corresponding to call waiting (see table 3 of ETS 300 392-9 [6]) - notification be delivered to the affected user MS/LS. The value of the information element call status in the ANF-ISIIC-ALERTING PDU shall correspond to call waiting;

- if the served user SwMI coincides with the affected user SwMI (i.e. the call is an intra-TETRA call), that SwMI shall send to the affected user MS/LS the notification indicator information element with the value corresponding to call waiting (see table 3 of ETS 300 392-9 [6]) in the D-ALERT PDU (see table 60 of ETS 300 392-2 [2]).

NOTE 2: The sending of that notification by the served user SwMI instead of by the affected user SwMI is for the case where the affected user SwMI would not support SS-CW.

5.4.2.1.2 Follow-up

5.4.2.1.2.1 No location change

After SS-CW has successfully been invoked for a call, the served user SwMI shall wait for receiving the U-CONNECT PDU (see table 79 of ETS 300 392-2 [2]) if the served user remains in the same registration area.

5.4.2.1.2.2 Case of roaming

If the served user has roamed calls with one or more calls in the call waiting state and if the served user SwMI supports the optional SS-CW location change procedure (i.e. the acceptance of waiting calls after such roaming), the served user SwMI shall wait for receiving the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the LOCATION CHANGE PDU, defined in table 12.

If it receives it after having completed the location change procedures for all the waiting calls, the new served user SwMI shall send back the LOCATION CHANGE ACK PDU, defined in table 13, to the served user MS. Otherwise it shall start the corresponding request timer Tloc_change and wait for the completion (successful or not) of the location change procedures for all waiting calls before timer Tloc_change expires for sending that LOCATION CHANGE ACK PDU.

After it has successfully completed the location change procedure for a call, the served user SwMI shall wait for receiving the U-CONNECT PDU (see table 79 of ETS 300 392-2 [2]), unless the served user roams again or migrates.

5.4.2.1.2.3 Case of migration

If the served user migrates into a new SwMI with one or more calls in the call waiting state, the served user SwMI may support the SS-CW migration procedure.

That procedure consists in invoking ANF-ISISS (see clause 10 of ETS 300 392-9 [6]) to send the MIGRATION PDU, defined in table 14, to that new SwMI together with the ANF-ISIIC-CALL RESTORE PREPARE PDU, else the ANF-ISIIC-END CALL RESTORE PREPARE PDU or the ANF-ISIIC-PATH RESTORE PREPARE PDU (see subclause 5.2.3). The served user SwMI shall then wait for receiving back the MIGRATION ACK PDU, defined in table 15, acknowledging the reception of the previous one, through ANF-ISIIS in a ROSE return result APDU with the same ROSE invoke identifier as that of the ROSE invoke APDU used by ANF-ISISS to convey the original MIGRATION PDU.

NOTE 1: Since node actions are not to be described as part of the protocol, it should be reminded that, according to ETS 300 392-11-11 [8], on SS-CW stage 2 description, once the served user SwMI has received that acknowledging MIGRATION ACK PDU, it will transfer the waiting call to the new served user SwMI, in cutting through its user information channel, i.e. its traffic channel, by forward switching.

If the served user SwMI receives the ANF-ISIIC-CONNECT PDU, else the ANF-ISIIC-PATH CLEARING PDU, before having received that acknowledging MIGRATION ACK PDU (see subclause 5.4.3.1), it shall not wait anymore for receiving it.

NOTE 2: No SS-CW timer applies for the reception of the acknowledging MIGRATION ACK PDU after the served user has sent the MIGRATION PDU because the PSS1 timers T303 and T310 apply for the reception of the ANF-ISIIC-PDU together with which the acknowledging MIGRATION ACK PDU is sent (by the new served user SwMI - see subclause 5.4.3.1).

If the new served user SwMI receives the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the LOCATION CHANGE PDU, defined in table 12, after it has taken over the role of served user SwMI (after having successfully completed the migration procedures for all waiting calls), it shall then send the D-FACILITY PDU (see subclause 7.3 of ETS 300 392-9 [6]) including the LOCATION CHANGE ACK PDU, defined in table 13.

After it has successfully completed the migration procedure for a call in the call waiting state, the new served user SwMI, which has taken over the served user SwMI role, shall wait for receiving the U-CONNECT PDU (see table 79 of ETS 300 392-2 [2]), unless the served user roams or migrates again. When it receives that U-CONNECT PDU, it will apply the basic call procedure (i.e. sending of the D-CONNECT PDU to the calling user if he is registered in the same SwMI, or of the ANF-ISIIC-CONNECT PDU otherwise). In addition, if that new served user SwMI is on the path of the original call and this is identified (i.e. it has received the ANF-ISIIC-END CALL RESTORE PREPARE PDU or the ANF-ISIIC-PATH RESTORE PREPARE PDU, defined in tables 51 and 50 of ETS 300 392-3-2 [4] respectively) the following shall apply:

- if the calling user has not himself migrated at the same time into the old served user SwMI (i.e. the terminating SwMI) the new served user SwMI shall send the ANF-ISIIC-PATH CLEARING PDU, defined in table 53 of ETS 300 392-3-2 [4]), to the old served user SwMI.

- if the new served user SwMI had received the ANF-ISIIC-PATH RESTORE PREPARE PDU and if the calling user has himself migrated at the same time into the new served user SwMI or into the old served user SwMI (i.e. the terminating SwMI), after the new served user SwMI has received the ANF-ISIIC PDU informing it about the corresponding successful call restoration for the calling user, the new served user SwMI shall send the ANF-ISIIC-PATH CLEARING PDU:

  - to the originating SwMI; and

  - if the calling user has migrated into the new served user SwMI, also to the old served user SwMI.

  NOTE 3: According to ETS 300 392-3-2 [4], the ANF-ISIIC-PATH CLEARING PDU is sent in the PSS1 DISCONNECT message.

5.4.2.2 Exceptional procedures

5.4.2.2.1 Invocation failure

When the served user MS/LS has sent the INVOKE PDU and that invocation fails, if the served user SwMI did not know that the served user MS/LS was busy when it offered the call, it shall send back the D-INFO PDU (see table 67 of ETS 300 392-2 [2]) including the INVOCATION FAILURE PDU, defined in table 10. The value of the information element invocation failure cause in that INVOCATION FAILURE PDU shall give the two corresponding failure cause (see table 20), which shall be one of the two following ones:

- the supplementary service has not been subscribed for him; or

- the supplementary service has been subscribed for him but not activated.

  NOTE 1: The case where the maximum number of calls in the call waiting state has already been reached is excluded because the served user SwMI would then have known that the served user MS/LS was busy when it offered the call.

When the served user MS/LS has sent the INVOKE PDU and that invocation fails, if the served user SwMI knew that the served user MS/LS was busy when it offered the call, it shall also send back the INVOCATION FAILURE PDU, defined in table 10, but in the D-RELEASE PDU (see table 68 of ETS 300 392-2 [2]). The corresponding disconnect cause in that D-RELEASE PDU shall be: called party busy. The possible values of the information element invocation failure (see table 20) may then be:

- the supplementary service has not been subscribed for him;

- the supplementary service has been subscribed for him but not activated; or

- the maximum number of calls in the call waiting state (i.e. for which SS-CW has successfully been invoked and which have not yet been accepted by the served user or cleared) has already been reached.

NOTE 2: Obviously the three failure reasons mentioned above are mutually exclusive. Thus there is no need to provide the possibility of more than one value of the information element invocation failure cause.

5.4.2.2.2 Location change failure

5.4.2.2.2.1 Partial failure in the case of roaming

If the served user has roamed with one or more calls in the call waiting state and if the served user SwMI supports the optional SS-CW location change procedure (i.e. the acceptance of waiting calls after such roaming), after the served user SwMI has received the LOCATION CHANGE PDU, defined in table 12, it shall indicate the number of waiting calls lost during the location change procedure (see subclause 5.2.2.9) in the LOCATION CHANGE ACK PDU, defined in table 13, which it sends back to the served user MS.

If the served user SwMI sends that LOCATION CHANGE PDU only when timer Tloc_change expires (i.e. before it has completed the location change procedures for all the calls in the call waiting state), in that PDU it shall indicate all waiting calls for which the location change procedures have not yet been completed as calls lost.

5.4.2.2.2.2 Case of migration

In case of migration of the served user with one or more calls in the call waiting state, if the served user SwMI does not support the SS-CW migration procedure, it shall clear the waiting call(s) with the disconnect cause: served user migration.

Similarly, still in case of migration of the served user with one or more calls in the call waiting state, if the served user SwMI has sent the MIGRATION PDU to the new served user SwMI (in case of migration of the served user), it shall clear the waiting call(s) with the same disconnect cause (served user migration):

- if it has received back the ROSE return error APDU indicating that the new served user SwMI has rejected the MIGRATION PDU because it does not support:
  - the SS-CW migration procedure (see subclause 5.4.3.2); or
  - SS-CW itself (see case b) in subclause 11.1.2 of ETS 300 392-9 [6]);
- if when it receives the ANF-ISIIC-CALL RESTORE PREPARED PDU, defined in table 48 of ETS 300 392-3-2 [4] from the new served user SwMI, it does not receive together with it the MIGRATION ACK PDU back, confirming the reception of the original MIGRATION ACK PDU (see subclause 5.4.3.1).

NOTE: Even if it does not support SS-CW, according to that subclause 11.1.2 of ETS 300 392-9 [6], the new served user SwMI should send the corresponding ROSE return error APDU in the PSS1 DISCONNECT or RELEASE message.

5.4.3 Actions at the new served user SwMI

The new served user SwMI is defined as the SwMI where the served user migrates with one or more calls in the call waiting state.

The only actions of the new served user SwMI are when that served user has just migrated into that SwMI. The corresponding SDL representation is shown in clause B.3 of annex B. After those actions are completed, the new served user SwMI ceases to exist because: either

- it has become the served user SwMI (see subclause 5.4.3.1); or
- the waiting call is cleared (see subclause 5.4.3.2).

5.4.3.1 Normal procedures (migration procedure)

If the served user migrates into the new served user SwMI, that SwMI may support the SS-CW migration procedure.

NOTE 1: The support of the migration procedure implies that the new served user SwMI supports the SS-CW location change procedure (see subclause 5.4.2.1.2.2).

That procedure starts with the reception of the MIGRATION PDU from the present served user SwMI (see subclause 5.4.2.1.2.3), sent through the invoked ANF-ISISS using the ROSE invoke APDU of the corresponding ROSE operation.

Depending on whether the served user keeps the call in the call waiting state or requests the new served user SwMI to connect it as soon as he is registered in that new SwMI, the new served user SwMI shall send back one of the following ANF-ISIIC PDUs:

- if the served user keeps the call in the call waiting state: the ANF-ISIIC-CALL RESTORE PREPARED PDU, defined in table 48 of ETS 300 392-3-2 [4]; or

- if the served user requests the new served user SwMI to connect the waiting call before that SwMI has sent the ANF-ISIIC-CALL RESTORE PREPARED PDU (i.e. as soon as he is registered in that new SwMI):

  - if the new served user SwMI had received the ANF-ISIIC-CALL RESTORE PREPARE PDU, defined in table 47 of ETS 300 392-3-2 [4]: the ANF-ISIIC-CONNECT PDU, defined in table 33 of ETS 300 392-3-2 [4];

  - if the new served user SwMI had received the ANF-ISIIC-END CALL RESTORE PREPARE PDU or the ANF-ISIIC-PATH RESTORE PREPARE PDU, defined in tables 51 and 50 of ETS 300 392-3-2 [4] respectively and if the calling user has not himself migrated at the same time into the new served user SwMI or the old served user SwMI (i.e. the terminating SwMI): the ANF-ISIIC-PATH CLEARING PDU, defined in table 53 of ETS 300 392-3-2 [4]. In addition, if the new served user SwMI had received the ANF-ISIIC-PATH RESTORE PREPARE PDU, it shall send the ANF-ISIIC-CONNECT PDU:

    - to the originating SwMI if the calling user has not himself migrated (at the same time) into the new served user SwMI or into the old served user SwMI nor, in case of call diversion, into the home SwMI of the originally called user when the call has been forward switched through that SwMI (see note 2 below);

    - if the call has been diverted and the calling user has himself migrated into the home SwMI of the originally called user when the call has been forward switched through that SwMI, to the home SwMI of the originally called user (i.e. the new originating SwMI).

  NOTE 2: The case of call diversion considered above is when the call has been forward switched through the home SwMI of the originally called user and at least one other SwMI. It may then happen that the served user migrates into the last SwMI through which the call has been forward switched and that at the same time the calling user migrates himself into the home SwMI of the originally called user.

  - if the new served user SwMI had received the ANF-ISIIC-END CALL RESTORE PREPARE PDU and if the calling user has himself migrated at the same time into the old served user SwMI (i.e. the terminating SwMI) or, in case of call diversion, the home SwMI of the originally called user when the call has been forward switched through that SwMI (i.e. that SwMI is identified by the originating SwMI as being on the waiting call path), after the new served user SwMI (i.e. the originating SwMI) has received the ANF-ISIIC PDU informing it about the corresponding successful call restoration for the calling user: the ANF-ISIIC-CONNECT PDU to the SwMI where the calling user has migrated (and restored the call); or

  - if the new served user SwMI had received the ANF-ISIIC-PATH RESTORE PREPARE PDU and if the calling user has himself migrated at the same time into the new served user SwMI or into the old served user SwMI (i.e. the terminating SwMI), after the new served user SwMI has received the ANF-ISIIC PDU informing it about the corresponding successful call restoration for the calling user:

    - the ANF-ISIIC-PATH CLEARING PDU to the originating SwMI; and

- depending on whether the calling user has migrated into the new served user SwMI or into the old served user SwMI: either

  - also the ANF-ISIIC-PATH CLEARING PDU to the old served user SwMI, i.e. the terminating SwMI, if the calling user has migrated into the new served user SwMI; or

  - the ANF-ISIIC-CONNECT PDU to the old served user SwMI, i.e. the terminating SwMI, if the calling user has migrated into that SwMI.

NOTE 3: According to ETS 300 392-3-2 [4], the ANF-ISIIC-CALL RESTORE PREPARED PDU is sent in the PSS1 CONNECT message, while the ANF-ISIIC-PATH CLEARING PDU is sent in the PSS1 DISCONNECT or RELEASE message.

When the new served user SwMI sends the ANF-ISIIC-CALL RESTORE PREPARED PDU (see the above case where the served user does not request immediately the new served user SwMI to connect the waiting call), it shall send back together with it the MIGRATION ACK PDU, defined in table 15, to the present served user SwMI. It shall do so in invoking ANF-ISISS to carry it. The invoked ANF-ISISS shall itself be carried in the same PSS1 facility information element as that carrying that ANF-ISIIC PDU (as a different APDU of the same ROSE operation - used by ANF-ISIIC), using the ROSE return result APDU with the same ROSE invoke identifier as that of the ROSE invoke APDU through which the MIGRATION PDU has been received (itself also carried by an invoked ANF-ISISS).

If the served user MS sends to the new served user SwMI the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the LOCATION CHANGE PDU, defined in table 12, before the new served user SwMI has completed the migration procedures for all the waiting calls (as indicated by the value of the information element number of waiting calls in the MIGRATION PDU, defined in table 14), the new served user SwMI shall start the corresponding request timer Tloc_change and wait for the completion (successful or not) of the migration procedures for all waiting calls before timer Tloc_change expires for sending back to the served user MS the LOCATION CHANGE ACK PDU, defined in table 13.

5.4.3.2 Exceptional procedures

If it does not support the SS-CW MIGRATION PDU (i.e. the SS-CW migration procedure), the new served user SwMI shall indicate it in sending the corresponding ROSE return error APDU to the present served user SwMI in the PSS1 DISCONNECT or RELEASE message according to subclause 8.4.3 of ETS 300 392-3-1 [3].

If timer Tloc_change expires before the new served user SwMI has completed the migration procedures for all the waiting calls (as indicated by the value of the information element number of waiting calls in the MIGRATION PDU, defined in table 14, else in the LOCATION CHANGE PDU received), the new served user SwMI shall send back the LOCATION CHANGE ACK PDU, defined in table 13, to the served user MS. That LOCATION CHANGE ACK PDU shall then indicate all waiting calls for which the migration procedures have not yet been completed as calls lost.

NOTE: According to subclause 5.4.3.1, the fact that the new served user SwMI has started timer Tloc_change means that it supports the SS-CW migration procedure and that it has received the LOCATION CHANGE PDU, defined in table 12, from the served user MS.

5.4.4 Actions at the affected user MS/LS

No specific procedures apply for the affected user MS/LS, beyond those specified in subclause 5.1.4.

NOTE: Such procedures result in the affected user MS/LS receiving:
- the notification indicator information element with the value corresponding to call waiting (see table 3 of ETS 300 392-9 [6]) in the D-ALERT PDU;
- the disconnect cause with the value corresponding to served user roaming or migration in the D-RELEASE PDU if:
  - in case of served user roaming, the served user SwMI does not support the location change procedure; or
  - in case of served user migration, the old served user SwMI or the new served user SwMI does not support the SS-CW migration procedure.

5.4.5 Actions at the affected user SwMI

When the served user SwMI has accepted the SS-CW invocation and when it is different from the affected user SwMI, the affected user SwMI shall receive in the PSS1 ALERTING message the ANF-ISIIC-ALERTING PDU (see table 32 of ETS 300 392-3-2 [4]). The value of the information element call status in that PDU shall correspond to call waiting.

In addition, that PDU shall include the notification indicator information element with the value corresponding to call waiting (see table 3 of ETS 300 392-9 [6]) - notification be delivered to the affected user MS/LS.

NOTE 1: If the affected user is equipped with a MS (and not with a LS), the affected user SwMI may then save the radio resource to that MS while the (individual) call is in the call waiting state.

NOTE 2: No specific procedures apply for the affected user SwMI for passing the notifications received from the served user SwMI to the affected user MS/LS (when the served user invokes SS-CW for the incoming call) beyond those for specified in subclause 5.1.5.

5.4.6 Actions at the served user home SwMI

The served user home SwMI may support the activation procedure. The corresponding SDL representation is shown in clause B.4 of annex B. That procedure consists:

- first in receiving from the served user MS/LS the U-FACILITY PDU (see table 4 of ETS 300 392-9 [6]) including the ACTIVATE PDU or DEACTIVATE PDU, defined in tables 6 and 8 respectively;

- then the served user home SwMI shall respond to the preceding activation or deactivation request in sending to the served user MS/LS the D-FACILITY PDU (see subclause 7.3 of ETS 300 392-9 [6]) including the ACTIVATE ACK PDU or DEACTIVATE ACK PDU, defined in tables 7 and 9 respectively.

If the activation or deactivation request has been successful, the value of the information element activation/deactivation result in those ACK PDUs (ACTIVATE ACK PDU or DEACTIVATE ACK PDU) shall indicate it as defined in table 17, and the value of the information element activation state shall confirm it as defined in table 18.

If the served user home SwMI has received the ACTIVATE PDU or the DEACTIVATE PDU from the MS/LS of a user for whom SS-CW has not been subscribed to, it shall include the corresponding information element values (see tables 17 and 16) in the corresponding ACK PDU (ACTIVATE ACK PDU or DEACTIVATE ACK PDU respectively).

5.5 SS-CW impact of interworking with other networks

5.5.1 SS-CW impact of interworking with other TETRA networks

The impact on the SS-CW call related procedures of interworking with other TETRA networks is limited:

- to the information of the affected user (i.e. the calling user of the individual call for which SS-CW has been invoked);

- to the case of migration of the served user with a call in the call waiting state.

Both have already been taken into account in the preceding clauses (for the served user migration, see subclauses 5.2.3, 5.4.2.1.2.3 and 5.4.3.1).

The only other SS-CW impact of interworking with other TETRA networks is the need to exchange information about SS-CW subscription and activation for the served user when that user migrates. It is addressed in subclause 5.6.2.2.

5.5.2 SS-CW impact of interworking with external networks

The calling party of an individual call may be an external user. In such a case it shall be up to the corresponding TETRA gateway to send to the external network the notification that the TETRA served user has (just) invoked SS-CW, if such procedure is supported in the external network.

If the external network supports the supplementary service SS-CW (as defined in that network), if the external user invokes that supplementary service successfully for an individual call from a TETRA calling user and if the external network notifies the other party of such invocation, the following procedures defined in subclause 5.4 for informing the TETRA calling user shall apply:

- the served user SwMI procedure, to the SwMI where the corresponding TETRA gateway lies;

- the affected user MS/LS procedure, to the MS/LS of the TETRA calling user of the waiting call; and

- the affected user SwMI procedure, to the SwMI where the TETRA calling user of the waiting call is currently registered.

5.6 Protocol interactions between SS-CW and other supplementary services and ANFs

5.6.1 Protocol interactions with other supplementary services

In case SS-CFNR has been invoked and the SS-CW served user is the diverted-to user, the served user SwMI may have already sent the D-ALERT PDU or the ANF-ISIIC ALERTING PDU depending on whether it is also the originating SwMI or not when it receives the U-ALERT PDU with the INVOKE PDU from the served user. It the served user SwMI accepts the corresponding SS-CW invocation, the procedure described in subclause 5.4.2.1 shall be modified as follows:

- if the served user SwMI does not coincide with the affected user SwMI (i.e. the call is over the ISI), the served user SwMI shall send in the PSS1 FACILITY message the ANF-ISIIC-INFO DEMAND PDU (see table 42 of ETS 300 392-3-2 [4]) including the notification indicator information element with the value corresponding to call waiting (see table 3 of ETS 300 392-9 [6]) - notification be delivered to the affected user MS/LS. The value of the information element call status in the ANF-ISIIC-INFO DEMAND PDU shall correspond to call waiting.

- if the served user SwMI coincides with the affected user SwMI (i.e. the call is an intra-TETRA call), that SwMI shall send to the affected user MS/LS the notification indicator information element with the value corresponding to call waiting (see table 3 of ETS 300 392-9 [6]) in the D-INFO PDU (see table 67 of ETS 300 392-2 [2]).

The same modified procedure described above shall apply if SS-CAD has been invoked in the served user SwMI with the call being diverted to a dispatcher before being authorized to continue and the served user invokes SS-CW for that call.

NOTE 1: More generally, the invocations of SS-CFNR or of SS-CAD with diversion to a dispatcher result:
- systematically in the sending of the D-INFO PDU by the originating SwMI instead of the D-ALERT PDU; and
- if such invocations occur in some other SwMI than the served user SwMI and the originating SwMI, in the sending by such SwMI of the PSS1 FACILITY message with the ANF-ISIIC-INFO DEMAND PDU instead of the PSS1 ALERTING message with the ANF-ISIIC ALERTING PDU.

The corresponding protocol interactions are defined in the stage 3 descriptions of SS-CFNR and SS-CAD.

No other protocol interactions between SS-CW and other supplementary services have been identified.

NOTE 2: Simultaneous conveyance of call unrelated PDUs for SS-CW and another supplementary service by the same U-FACILITY PDU, each in accordance with the requirements of the stage 3 description of that supplementary service, does not, on its own, constitute a protocol interaction. The same holds when such PDUs are conveyed by the ANF-ISISS ROSE invoke APDU, else by the same PSS1 FACILITY message.

Neither is a protocol interaction the recommendation that if the served user has invoked SS-CW for a call and now wants to accept it and if he is already engaged in an individual call which he does not want to clear, he should first put that individual call on hold.

5.6.2 Protocol interactions with ANFs

5.6.2.1 Interaction with ANF-ISIGC, ANF-ISIIC and ANF-ISISS

Since SS-CW does not apply to group calls, there shall not be any protocol interactions between SS-CW and ANF-ISIGC.

The protocol interactions between SS-CW and ANF-ISIIC have already been taken into account in subclause 5.4.

As to ANF-ISISS, there are no protocol interactions between it and SS-CW.

NOTE: The use of ANF-ISISS for conveying call unrelated SS-CW PDUs over the ISI has not been considered as a protocol interaction to be addressed in this ETS.

5.6.2.2 Interactions with ANF-ISIMM

5.6.2.2.1 Migration of the served user

When the served user migrates into a visited SwMI, the following exchange of information shall be ensured, through ANF-ISIMM (see ETS 300 392-3-5 [5]):

- the information element basic migration profile (original) in the ANF-ISIMM-PROFILE PDU sent with the value of the profile type information element corresponding to individual subscriber shall indicate that SS-CW has been subscribed for the served user;

- the visited SwMI shall inform the home SwMI whether or not it supports SS-CW in the ANF-ISIMM-PROFILE RESPONSE PDU sent back in setting the value of the information element basic migration profile info to 0 (i.e. profile accepted as received);

- unless the home SwMI has received earlier the information that the visited SwMI does not support SS-CW (in the ANF-ISIMM-PROFILE RESPONSE PDU), when the home SwMI sends the ANF-ISIMM-SS-PROFILE UPDATE PDU to the visited SwMI, it shall include in that PDU the information sub-element CW-ISI-PROFILE defined in table 23 in the information element SS-migration profile (original) with the value of the information sub-element SS-type corresponding to SS-CW. The value of the accompanying information sub-element profile status corresponds then to profile replacement;

- the visited SwMI shall then acknowledge the SS-CW profile information received in the ANF-ISIMM-SS-PROFILE UPDATE PDU as defined in ETS 300 392-3-5 [5].

5.6.2.2.2 SS-CW activation changes of the served user

After the migration procedure specified for SS-CW in subclause 5.6.2.2.1 has taken place for the served user, i.e. the home SwMI knows that the visited SwMI supports SS-CW and has transferred the activation state of that supplementary service for the served user, that activation state may change.

In such a case, when the home SwMI decides to inform the visited SwMI about such change, it shall do so in sending the ANF-ISIMM-SS-PROFILE UPDATE PDU including the information sub-element CW-ISI-PROFILE defined in table 23 in the information element SS-migration profile (original) with the value of the information sub-element SS-type corresponding to SS-CW. The value of the accompanying information sub-element profile status corresponds then to profile replacement.

The visited SwMI shall then acknowledge the SS-CW profile information received in the ANF-ISIMM-SS-PROFILE UPDATE PDU as defined in ETS 300 392-3-5 [5].

5.7 SS-CW parameter value (timer)

The only specific SS-CW timer for SS-CW procedures is the timer Tloc_change. It is started by the served user SwMI which has received the LOCATION CHANGE PDU, defined in table 12 (after the served user has roamed or migrated). Its purpose is to ensure that that SwMI does not delay too much its response to that LOCATION CHANGE PDU (in sending the LOCATION CHANGE ACK PDU, defined in table 13), when the location change procedures for one or more waiting calls are too much delayed.

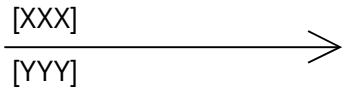
Timer Tloc_change should have an initial value smaller than 15 seconds.

In addition, the SS-CW procedures are highly related to the basic call procedures which use (the basic call) timers T304 (see note 1 in subclause 5.4.1.1.1) and T2 (see note 1 in subclause 5.4.2.1). Except for special applications, if they are less than 30 seconds the initial values of both timers should be extended to at least 30 seconds when SS-CW is invoked.

Annex A (informative): Examples of message sequences

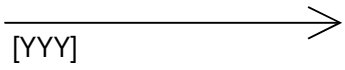
Annex A describes some typical message flows for SS-CW. The following conventions are used in the figures of this annex.

The following notation is used:



where XXX above the arrow refers to a basic call PDU (i.e. either over the air/line station interface or over the ISI), and YYY below the arrow refers to the specific SS-CW information element carried by the basic call PDU when that PDU is over the air/line station interface, or together with it when that PDU is over the ISI.

If the SS-CW PDU is independent of basic call, it is simply shown as:



The figures show messages exchanged over the air (or line station) interface via the Circuit Mode Control entities (CMCE - see clause 14 of ETS 300 392-2 [2]) and over the ISI by the PSS1 Protocol Control between SwMIs involved in SS-CW. Only messages relevant to SS-CW are shown.

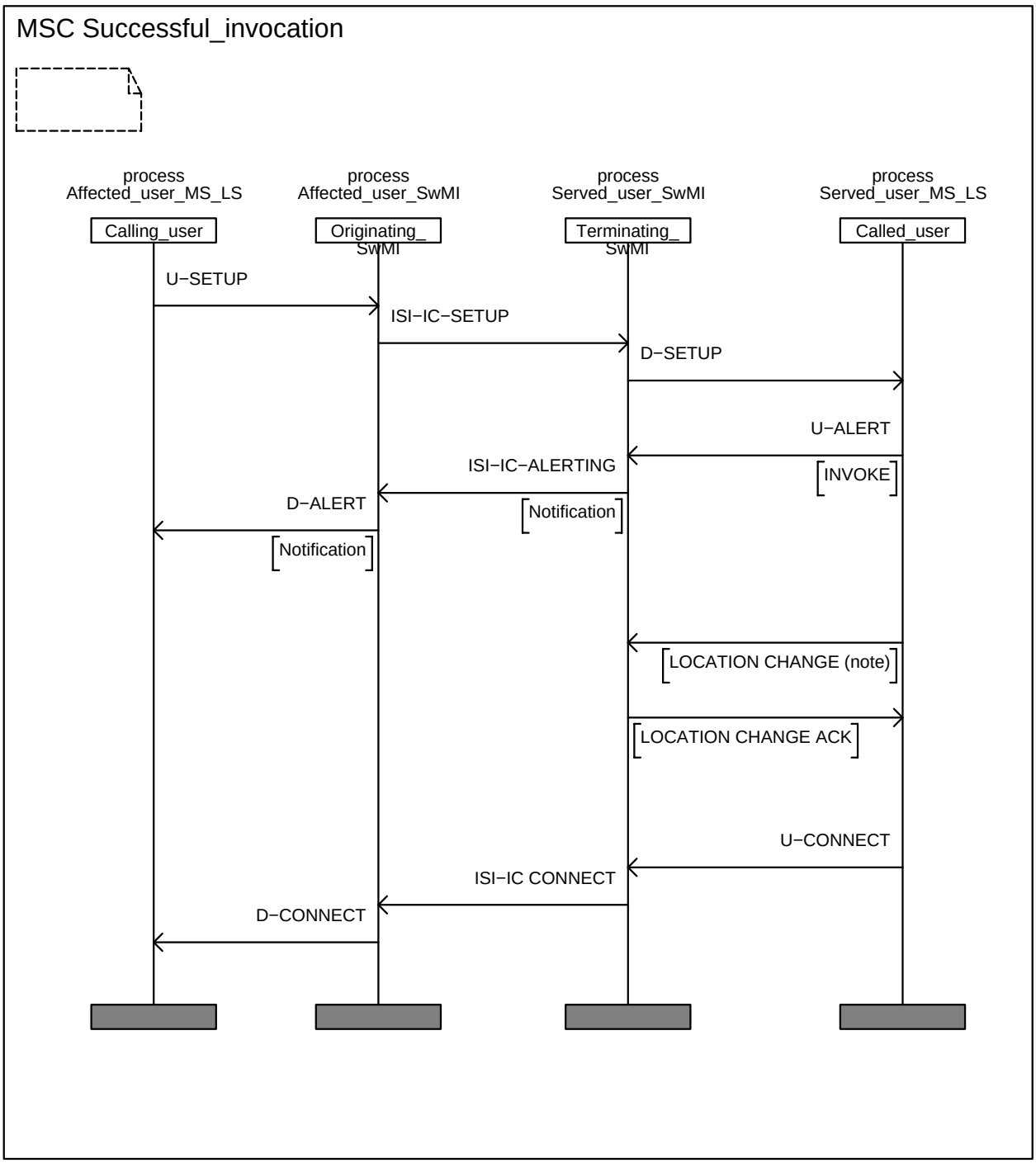
The facility information elements containing the ROSE APDUs are not explicitly shown. Information with no impact on SS-CW is not shown.

A.1 Example message sequence for successful operation of SS-CW

Figure A.1 shows an example of successful operation of SS-CW.

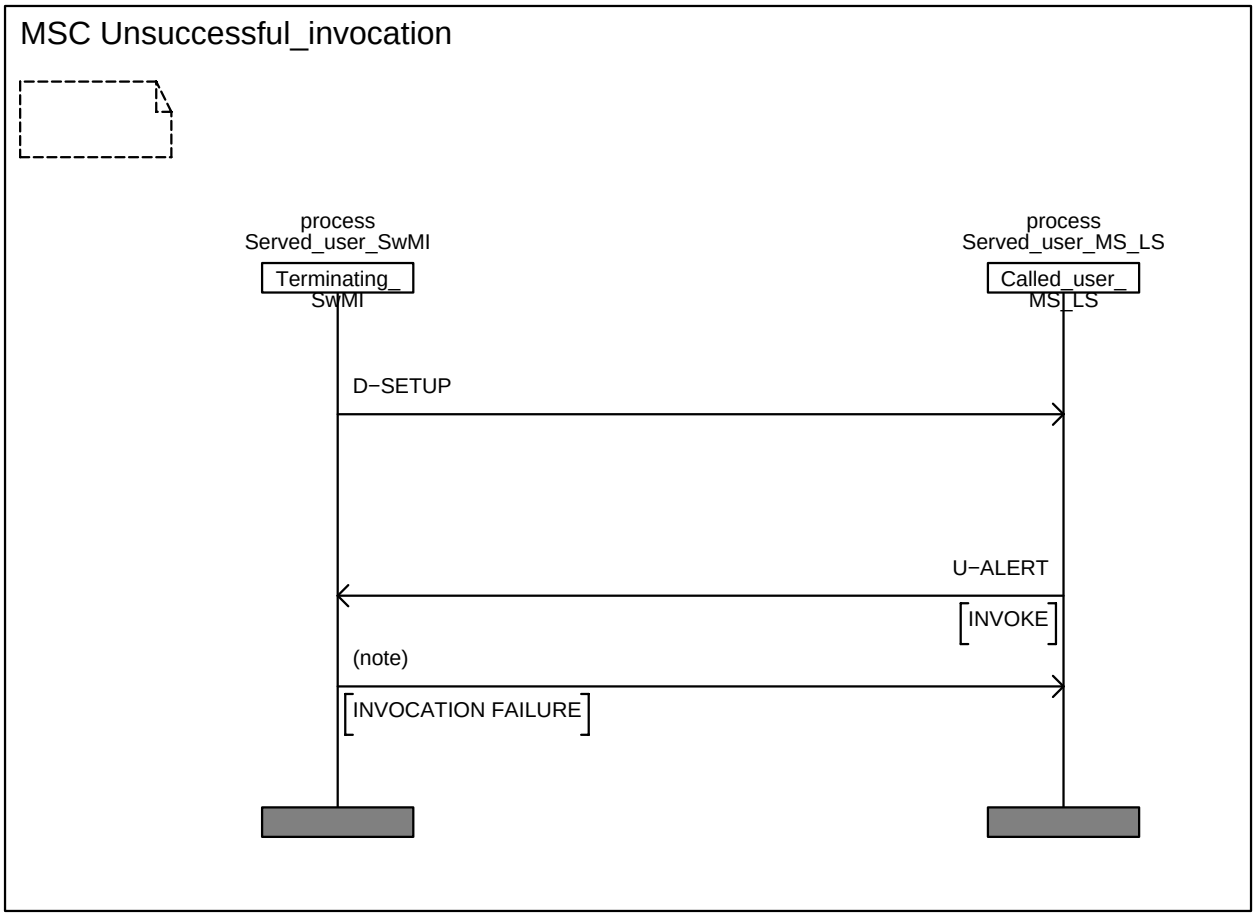
A.2 Example message sequence for unsuccessful operation of SS-CW

Figure A.2 shows an example of unsuccessful operation of SS-CW.



NOTE: The LOCATION CHANGE PDU shall be sent by the served user MS in the cases of roaming or migration and only in such cases. That MS expects then to receive the LOCATION CHANGE ACK PDU. The figure illustrates only the case of roaming.

Figure A.1: Message sequence for successful operation of SS-CW



NOTE: The figure corresponds to the case where the basic call procedure continues after SS-CW invocation has failed. The case where the call is cleared because of that invocation failure is also possible (see subclause 5.4.2.2): the INVOCATION FAILURE PDU shall then be sent in the D-RELEASE PDU.

Figure A.2: Message sequence for unsuccessful operation of SS-CW

Annex B (informative): Specification and Description Language (SDL) representation of procedures

The diagrams in annex B use the Specification and Description Language defined in ITU-T Recommendation Z.100 [9].

The diagrams for MS/LSs and SwMIs represent the behaviour of SS-CW supplementary service control entities at those MS/LSs and SwMIs, respectively.

For SS-CW protocol at the air interface (or line station interface), in accordance with the protocol model described in clause 14 of ETS 300 392-2 [2], the supplementary service control entity at a MS/LS uses the services of the (air/line station interface):

- basic call control, for SS-CW invocation and operation procedures;

- U-FACILITY and D-FACILITY PDUs, for SS-CW activation/deactivation and/or location change procedures (the latter being part of the operation procedures).

The same applies for the supplementary service control entity at the SwMI where the user of a MS/LS is registered for the corresponding SS-CW protocol at the air/line station interface.

For SS-CW protocol over the ISI, in accordance with the protocol model described in clause 8 of ETS 300 392-3-1 [3], the supplementary service control entity (at a SwMI) uses, via the co-ordination function, the services of ANF-ISISS and in addition, for call related procedures, of ANF-ISIIC.

The basic call actions associated with the sending and receiving of the air/line station interface PDUs specified in ETS 300 392-2 [2] are deemed to occur. The same applies with the sending and receiving of the ANF-ISIIC PDUs specified in ETS 300 392-3-2 [4].

The suffix PDU has been omitted after the PDU names (e.g. ACTIVATE or INVOKE).

The basic call PDUs at the air interface or at the ISI which do not carry any SS-CW information have not been shown on the figures.

B.1 SDL representation of SS-CW at the served user MS/LS

Figure B.1 shows the behaviour of a SS-CW supplementary service control entity within the served user MS/LS.

Input signals from the right represent air interface PDUs received from the served user SwMI.

Output signals to the right represent air interface PDUs sent to the served user SwMI.

Input signals from the left represent primitives from the served user application.

Output signals to the left represent primitives to the served user application.

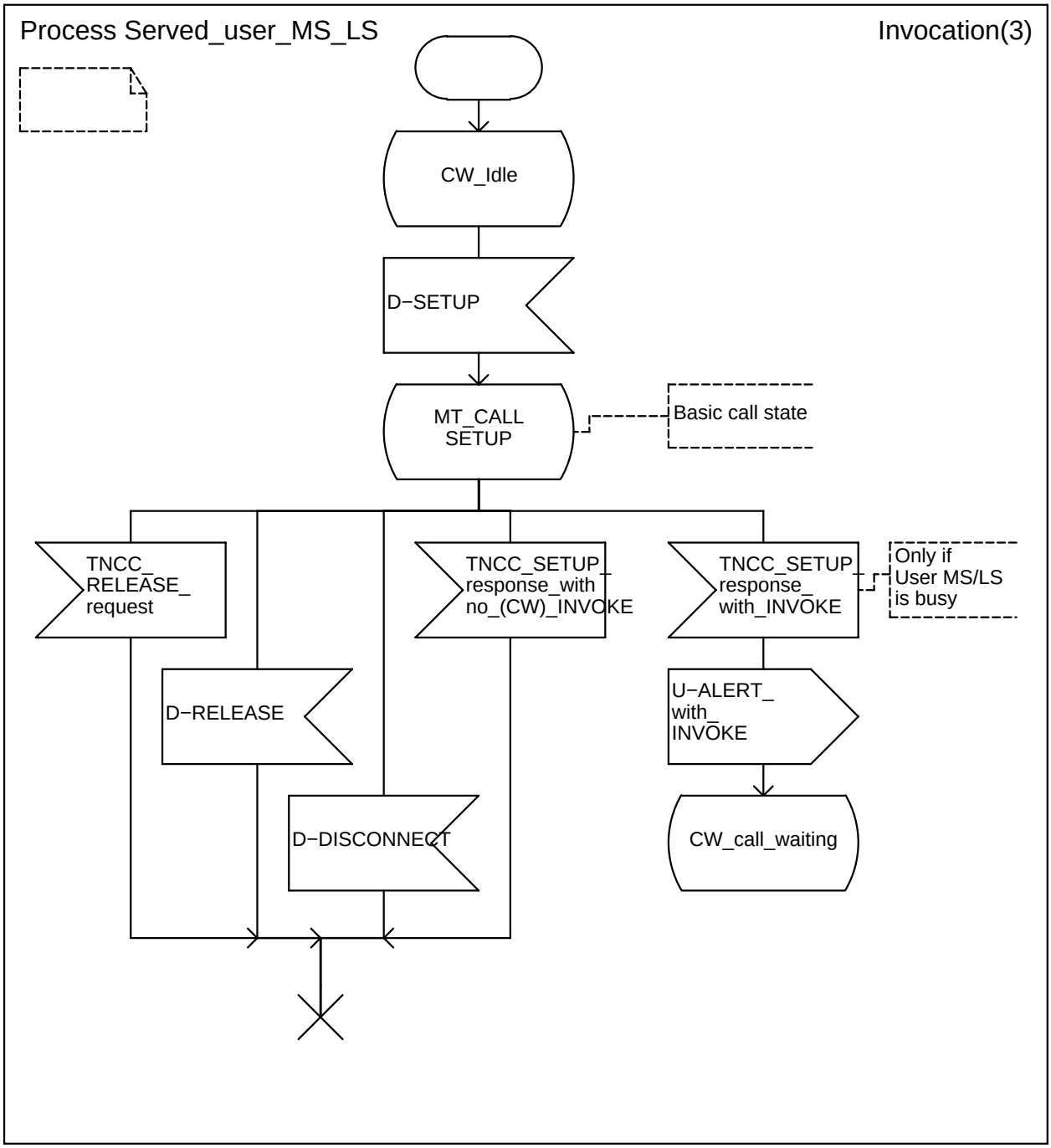


Figure B.1a (sheet 1 of 3): Served user MS/LS SDL - Invocation

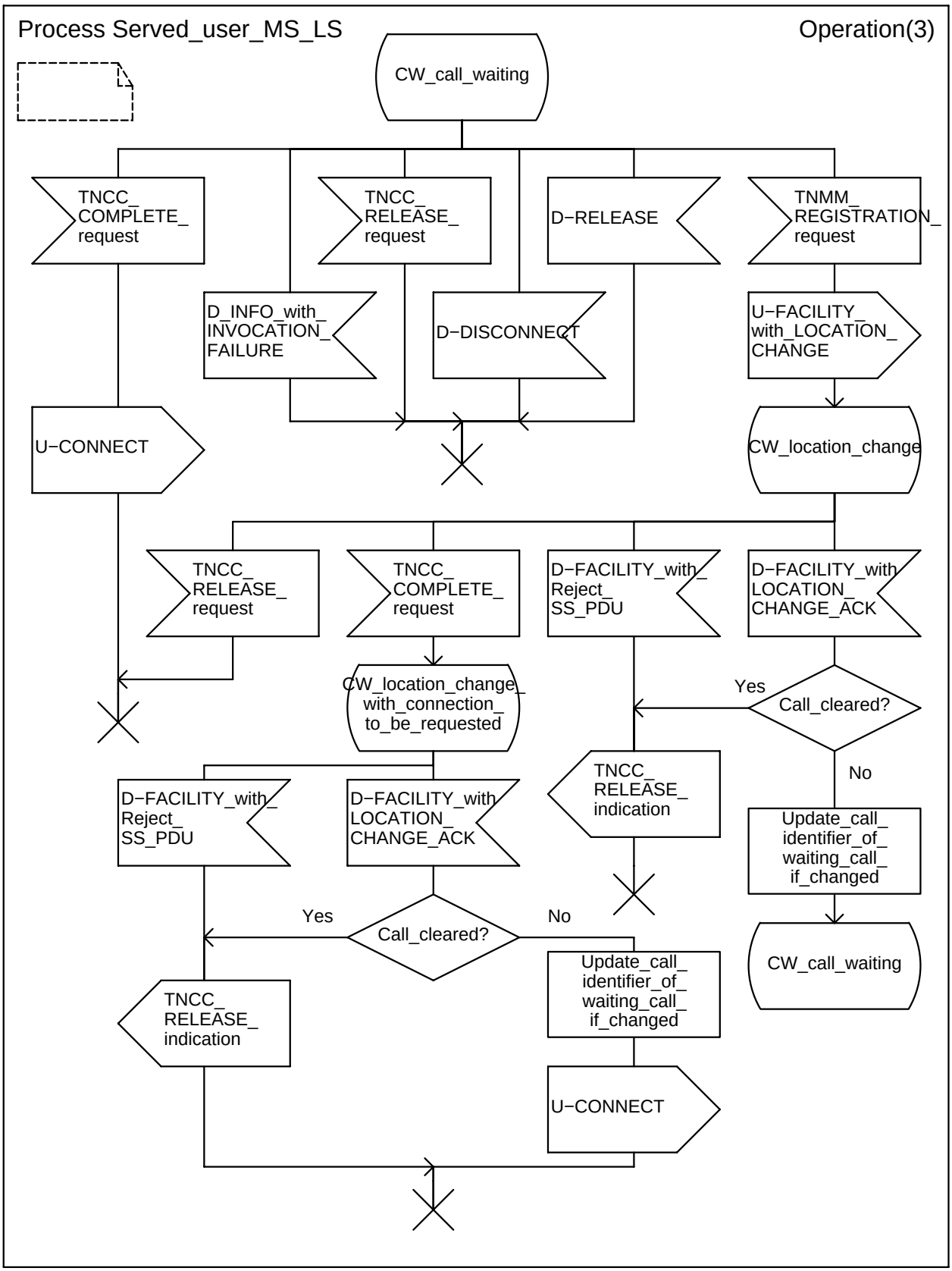


Figure B.1b (sheet 2 of 3): Served user MS/LS SDL - Operation

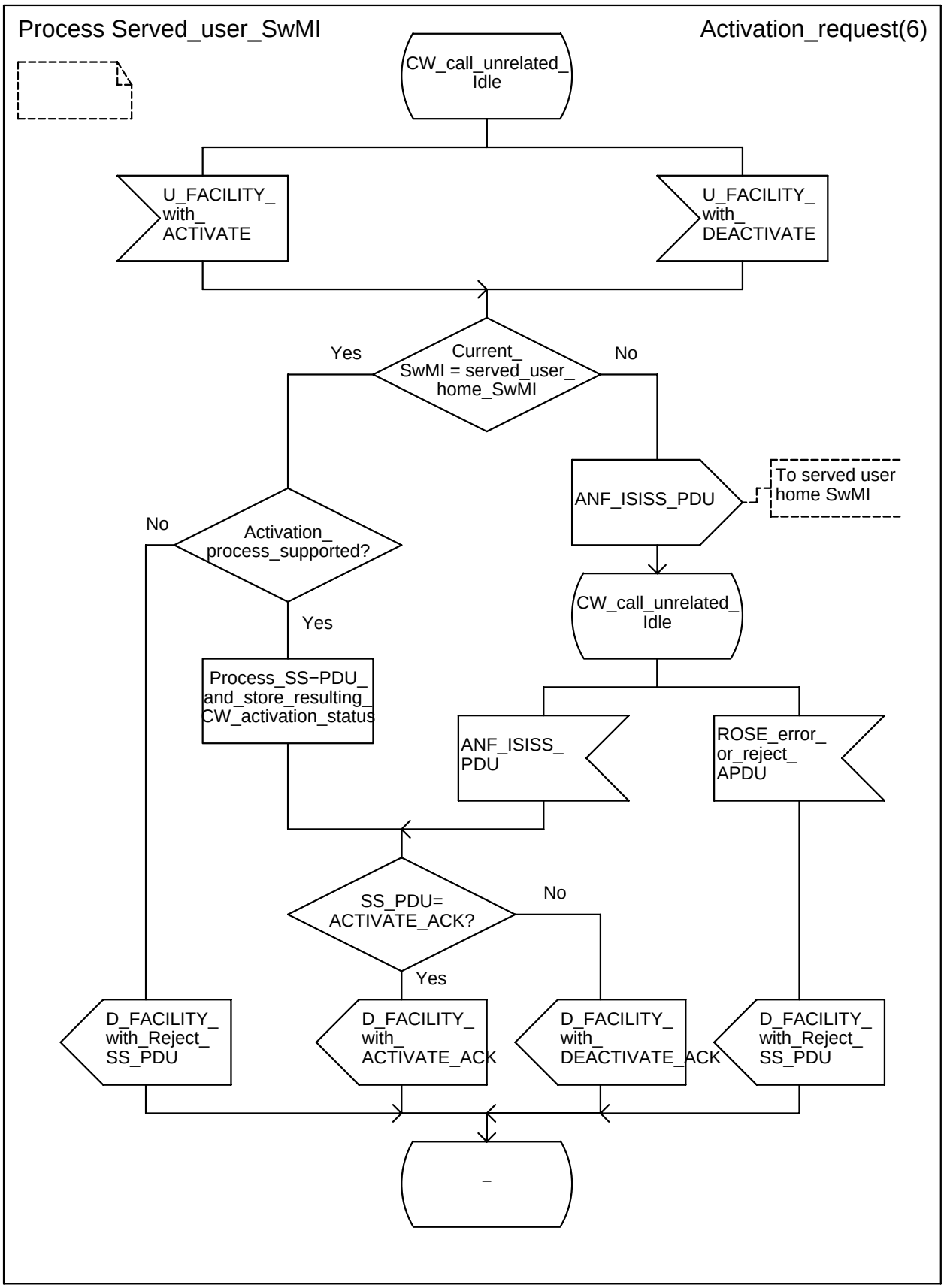


Figure B.1c (sheet 3 of 3): Served user MS/LS SDL - Activation request

B.2 SDL representation of SS-CW at the served user SwMI

Figure B.2 shows the behaviour of an SS-CW supplementary service control entity within the served user SwMI.

The meaning of the input signals from the right and of the output signals to the right is different for the various sheets of figure B.2:

- on sheet 1 of figure B.2, the basic call SETUP PDU is: either
    - the (air interface) U-SETUP PDU if the calling user is registered in the served user SwMI (i.e. case of intra-TETRA call); or
    - the ANF-ISIIC-SETUP PDU, otherwise;
- on sheet 2 of figure B.2, the basic call ALERT and DISCONNECT PDUs are respectively: either
    - the D-ALERT PDU, sent to the calling user, and U-DISCONNECT PDU, received from that user, if he is registered in the served user SwMI; or
    - the ANF-ISIIC-ALERTING, sent to the originating SwMI, and ANF-ISIIC-DISCONNECT PDUs, received from that SwMI, otherwise;
- on sheet 3 of figure B.2:
    - the primitive informing the served user SwMI about the served user migration is received from its mobility management entity, via ANF-ISIMM;
    - the MIGRATION PDU is sent to the new served user SwMI, and the MIGRATION ACK PDU, the ISI-CONNECT PDU or the ROSE return error or reject APDU, received from that SwMI. Similarly, the ANF-ISIIC-PATH CLEARING PDU is received from the new served user SwMI;
    - when the served user SwMI detects that the migration procedure has failed, the following basic call clearing PDUs are sent: either
        - D-RELEASE PDU, to the calling user, if that user is registered in the served user SwMI (i.e. case of intra-TETRA call); or
        - the ANF-ISIIC-DISCONNECT PDU, to the originating SwMI, otherwise.
- on sheet 4 of figure B.2, the basic call D-CONNECT PDU is sent to the calling user if that user is registered in the served user SwMI (i.e. case of intra-TETRA call) or the ANF-ISIIC-CONNECT PDU is sent to the originating SwMI, otherwise;
- on sheet 5 of figure B.2, the ANF-ISISS PDUs are exchanged with the served user home SwMI;
- on sheet 6 of figure B.2, the primitive about SS-CW activation state is received from the mobility management entity in the served user SwMI, via ANF-ISIMM;

    NOTE: Sheet 6 of figure B.2 exists only in the case where the served user SwMI is different from the served user home SwMI.

Input signals from the left represent PDUs received from the served user MS/LS.

Output signals to the left represent PDUs sent to the served user MS/LS.

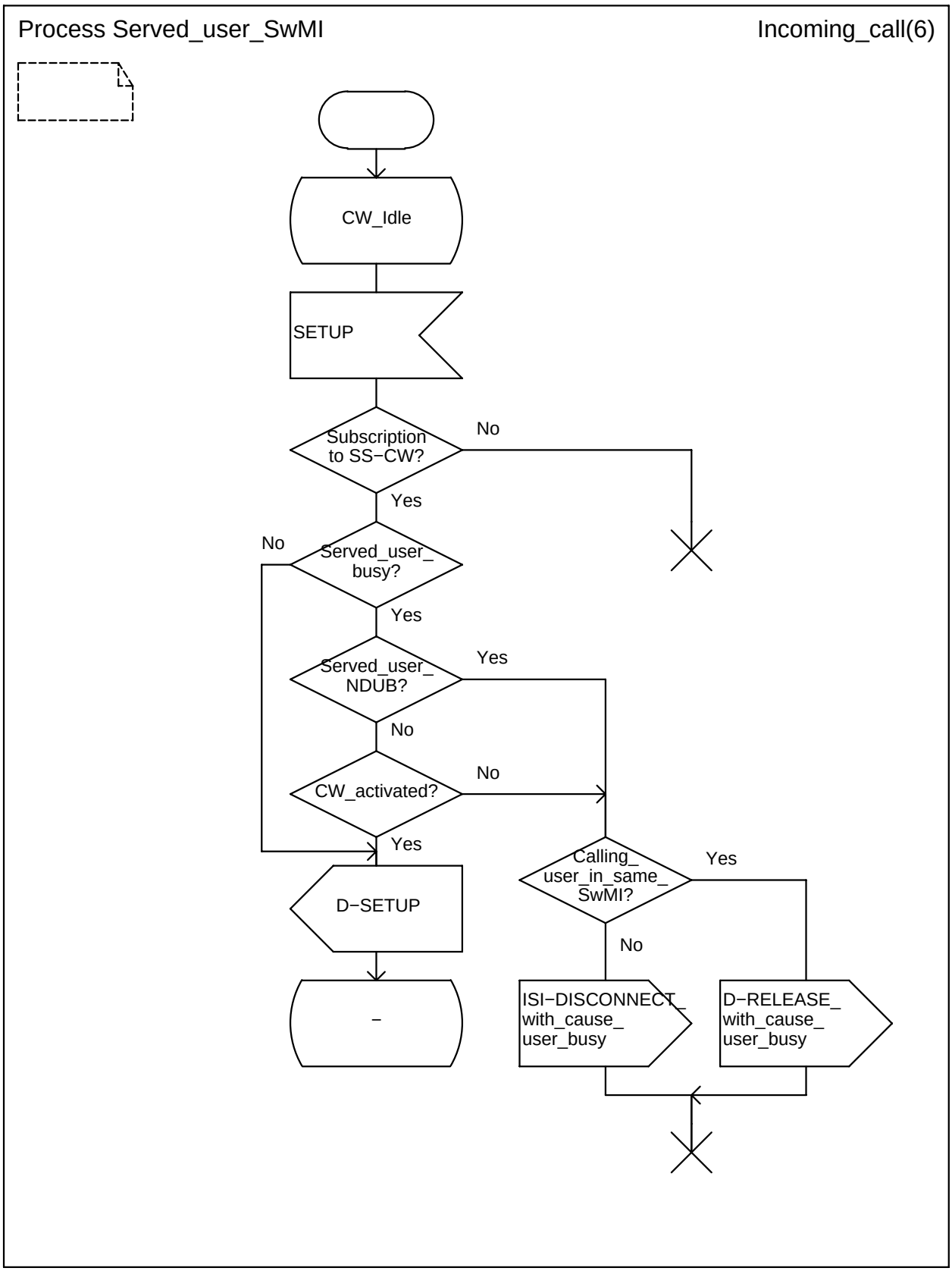


Figure B.2a (sheet 1 of 6): Served user SwMI SDL - Incoming call

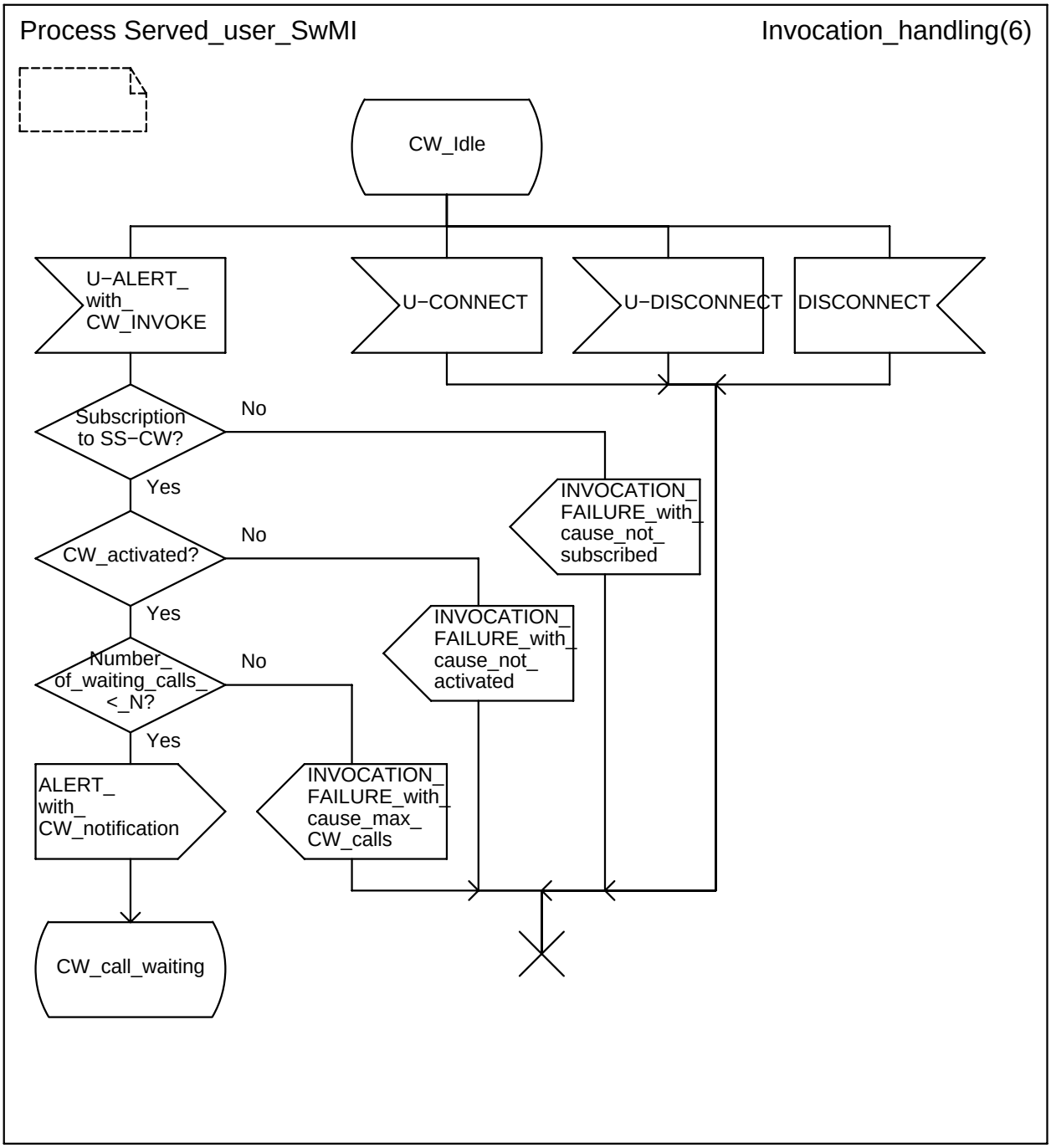
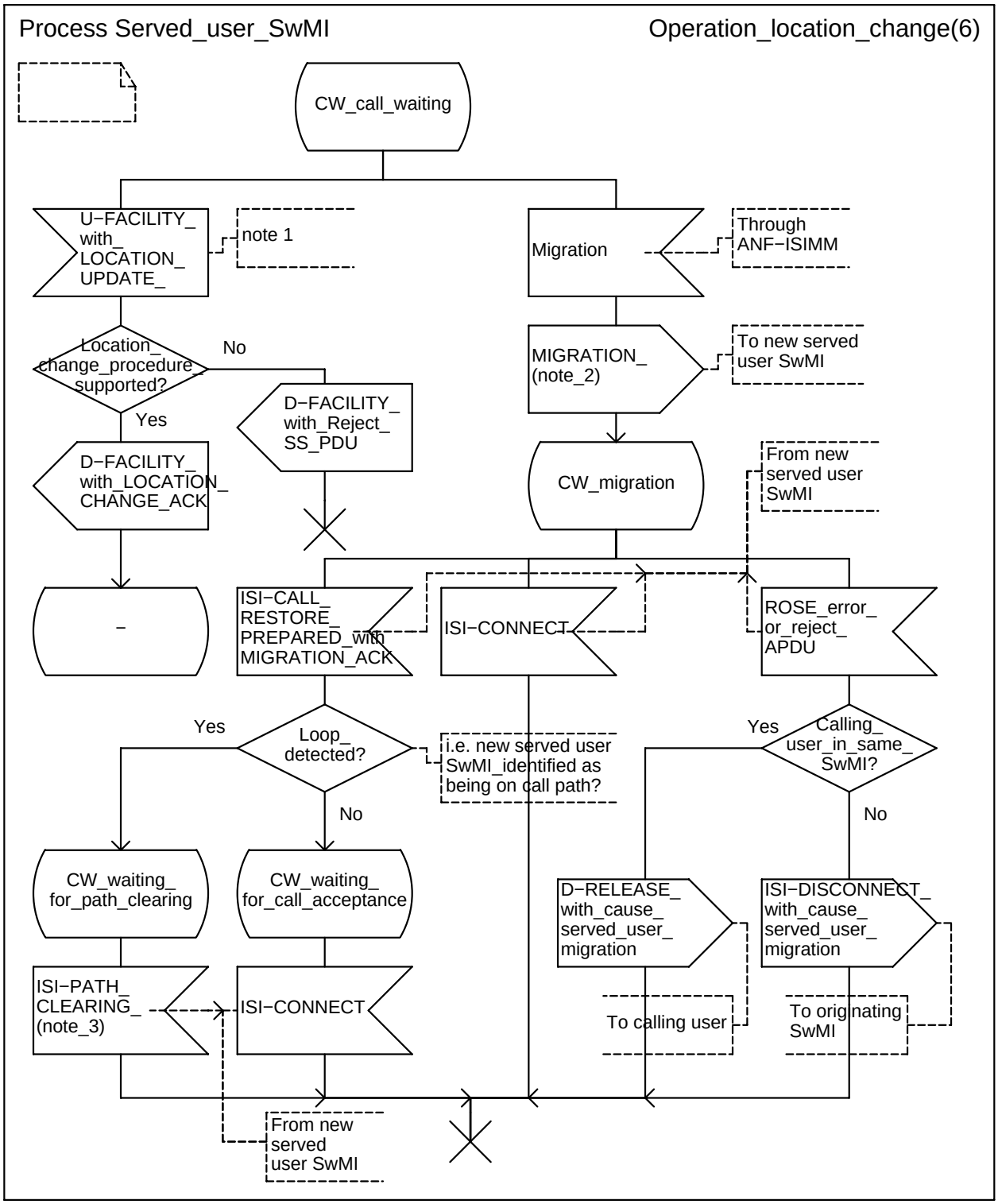


Figure B.2b (sheet 2 of 6): Served user SwMI SDL - Beginning of operation

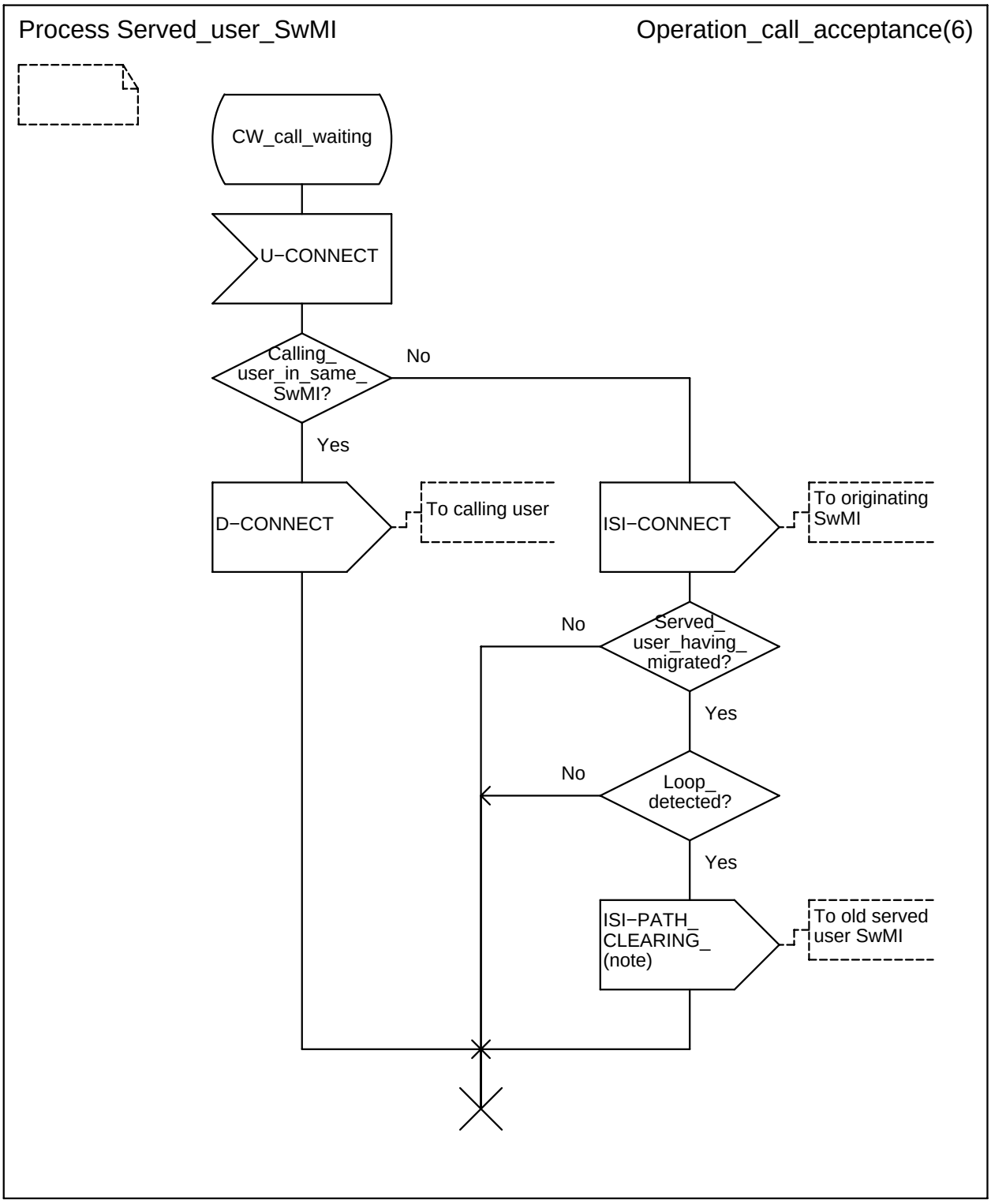


NOTE 1: In the case of migration, i.e. when the new served user SwMI receives the LOCATION CHANGE PDU only after it has taken over the role of served user SwMI (see subclause 5.4.2.1.2.3), the test on the support of the location change procedure in that SDL branch shall always be positive.

NOTE 2: The various ANF-ISIIC PDUs with which the (SS-CW) MIGRATION PDU shall possibly be sent have not been shown on the figure.

NOTE 3: The case where the calling user has migrated at the same time into a SwMI also on the path of the call and the served user SwMI is informed about it has not been taken into account.

Figure B.2c (sheet 3 of 6): Served user SwMI SDL - Location change operation



NOTE: The case where the calling user has migrated at the same time into a SwMI also on the path of the call and the served user SwMI is informed about that situation has not been taken into account.

Figure B.2d (sheet 4 of 6): Served user SwMI SDL - Call acceptance

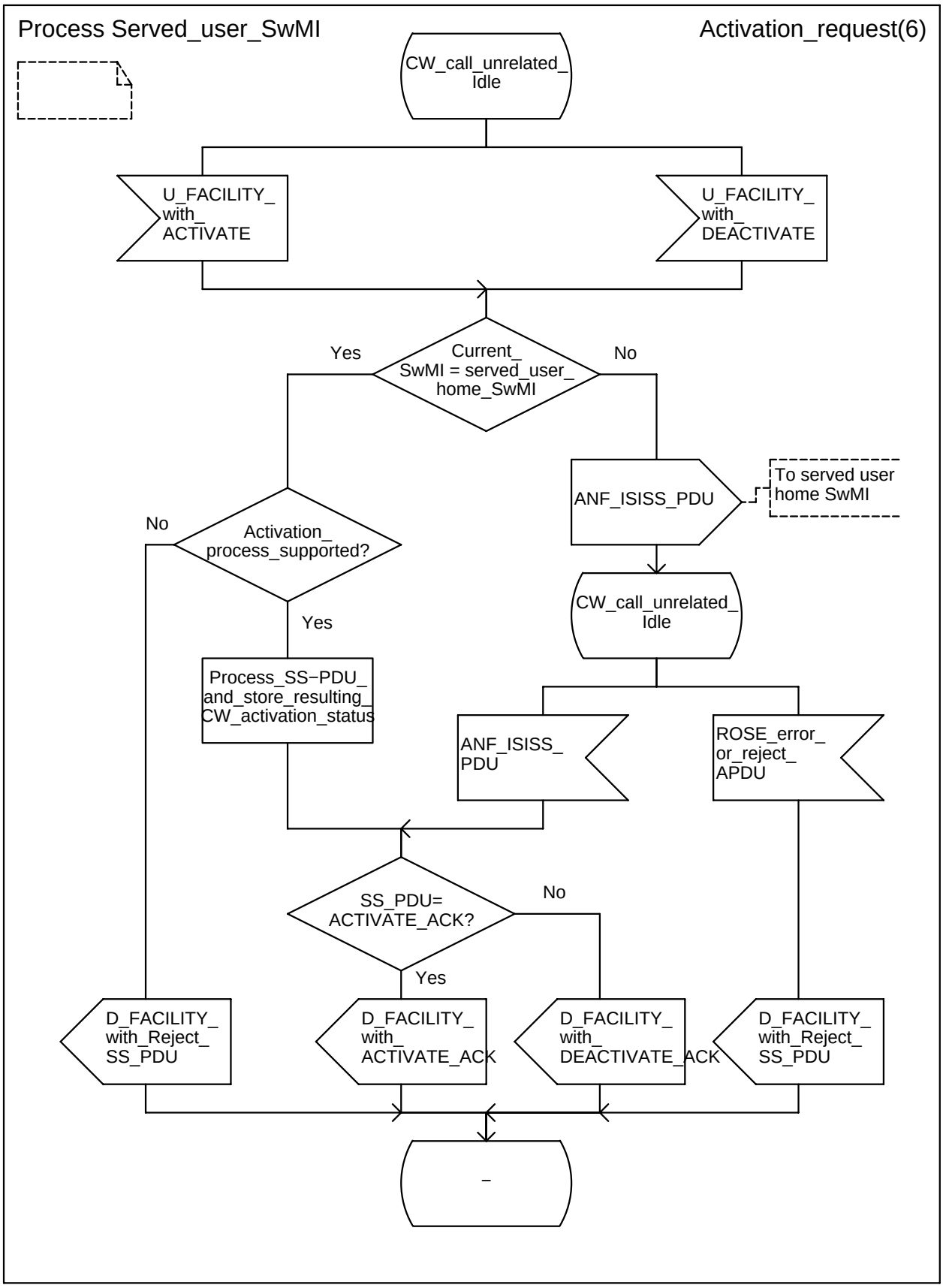


Figure B.2e (sheet 5 of 6): Served user SwMI SDL - Activation request

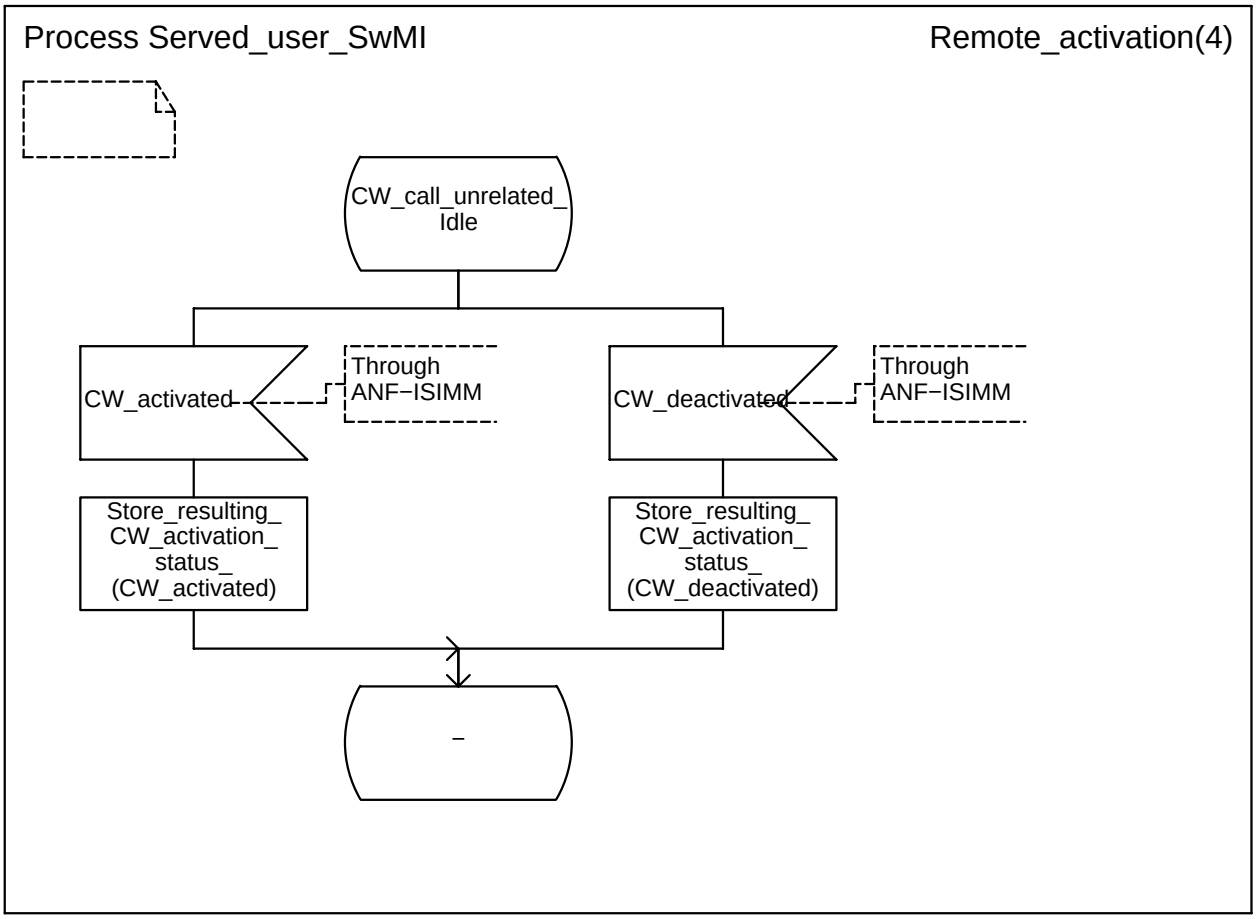


Figure B.2f (sheet 6 of 6): Served user SwMI SDL - Remote activation

B.3 SDL representation of SS-CW at the new served user SwMI

Figure B.3 shows first how the new served user SwMI SDL process is created, then it shows the behaviour of the supplementary service control entity specific to the new served user SwMI.

Input signals from the right represent either a PDU received from the old served user SwMI or expiry of the timer for answering the served user request for new call identifiers.

The output signal to the right represents a PDU sent to the old served user SwMI.

Input signals from the left represent PDUs sent from the served user.

The output signal to the left represents a PDU sent to the served user.

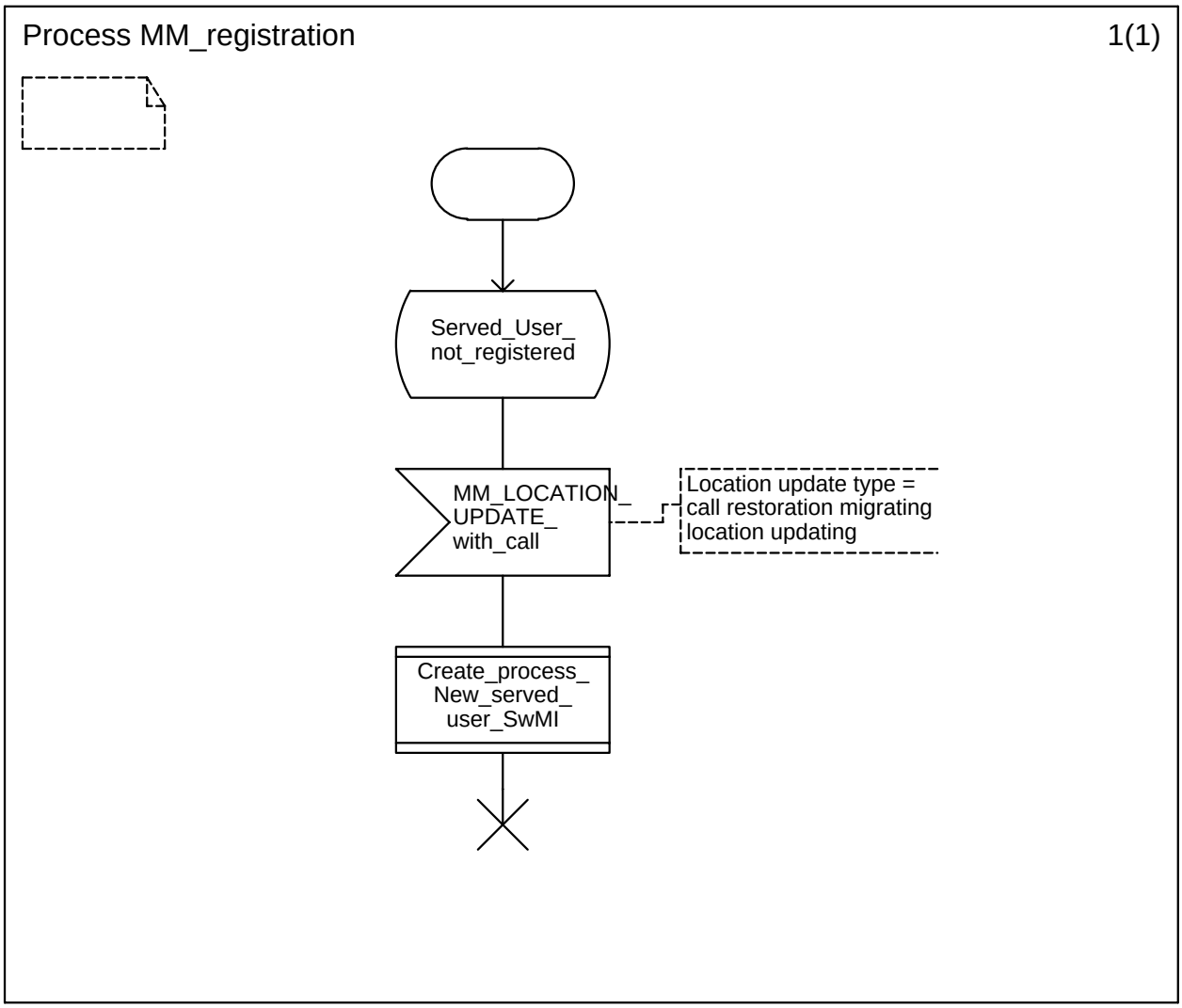


Figure B.3a (sheet 1 of 3): New served user SwMI SDL - SDL process creation

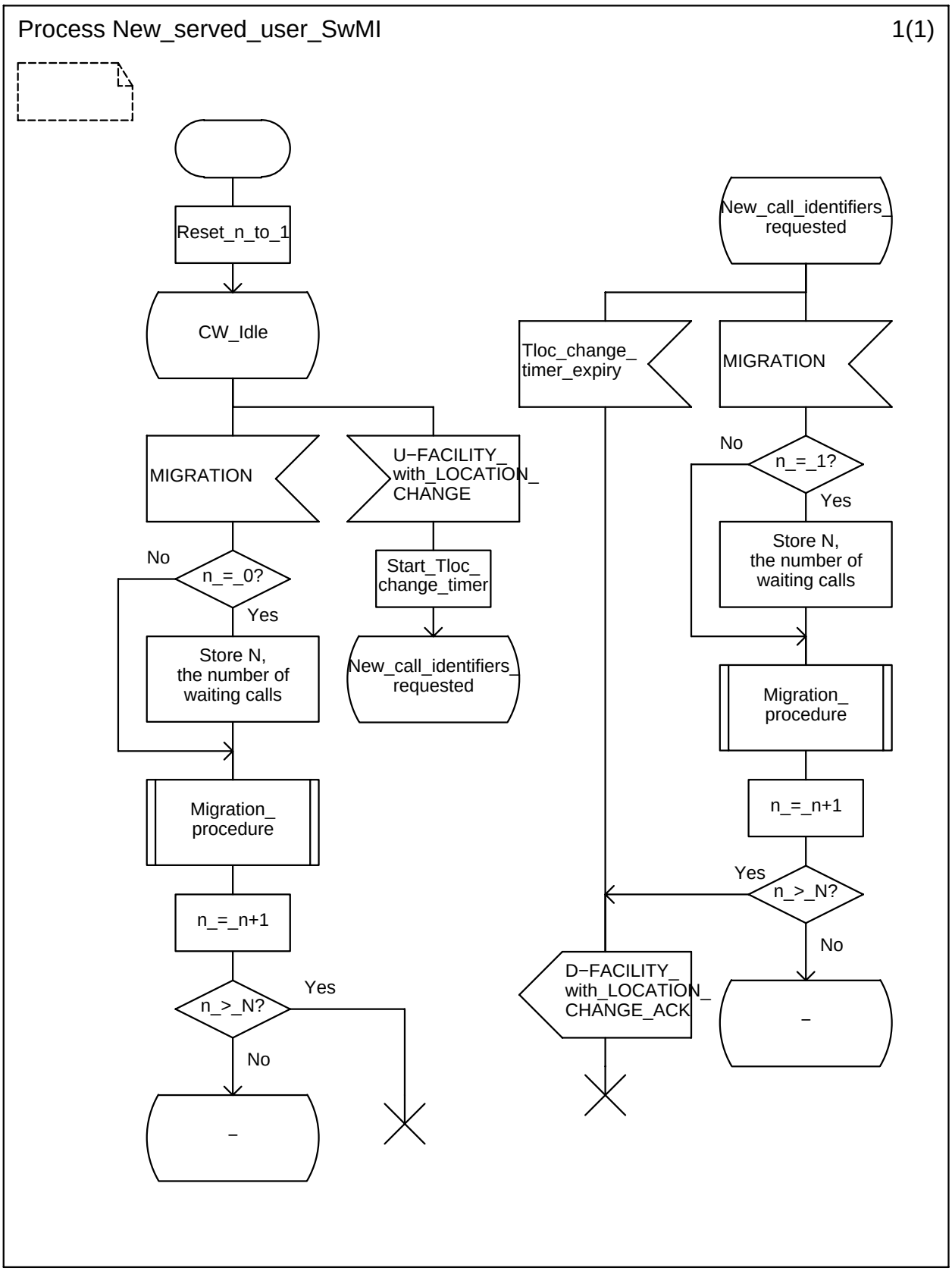
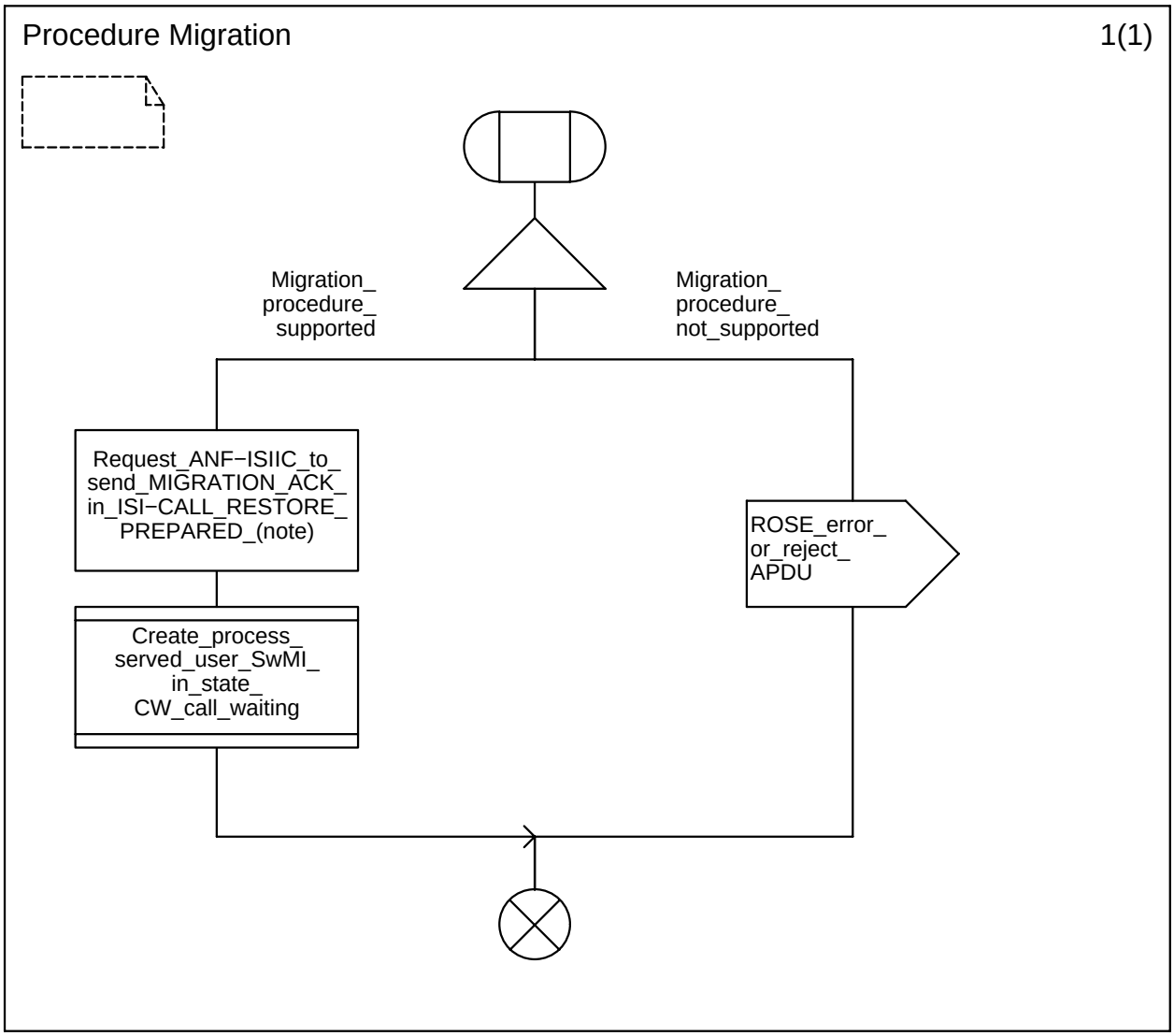


Figure B.3b (sheet 2 of 3): New served user SwMI SDL - Overall



NOTE: ANF-ISIIC may delay the sending of the ANF-ISIIC-CALL RESTORE PREPARED PDU by a few seconds. If the served user decides to accept the waiting call during that time (in sending the U-CONNECT PDU), ANF-ISIIC may skip the sending of the ANF-ISIIC-CALL RESTORE PREPARED PDU in sending directly the ANF-CONNECT PDU. In such a case, the MIGRATION ACK PDU will not be sent.

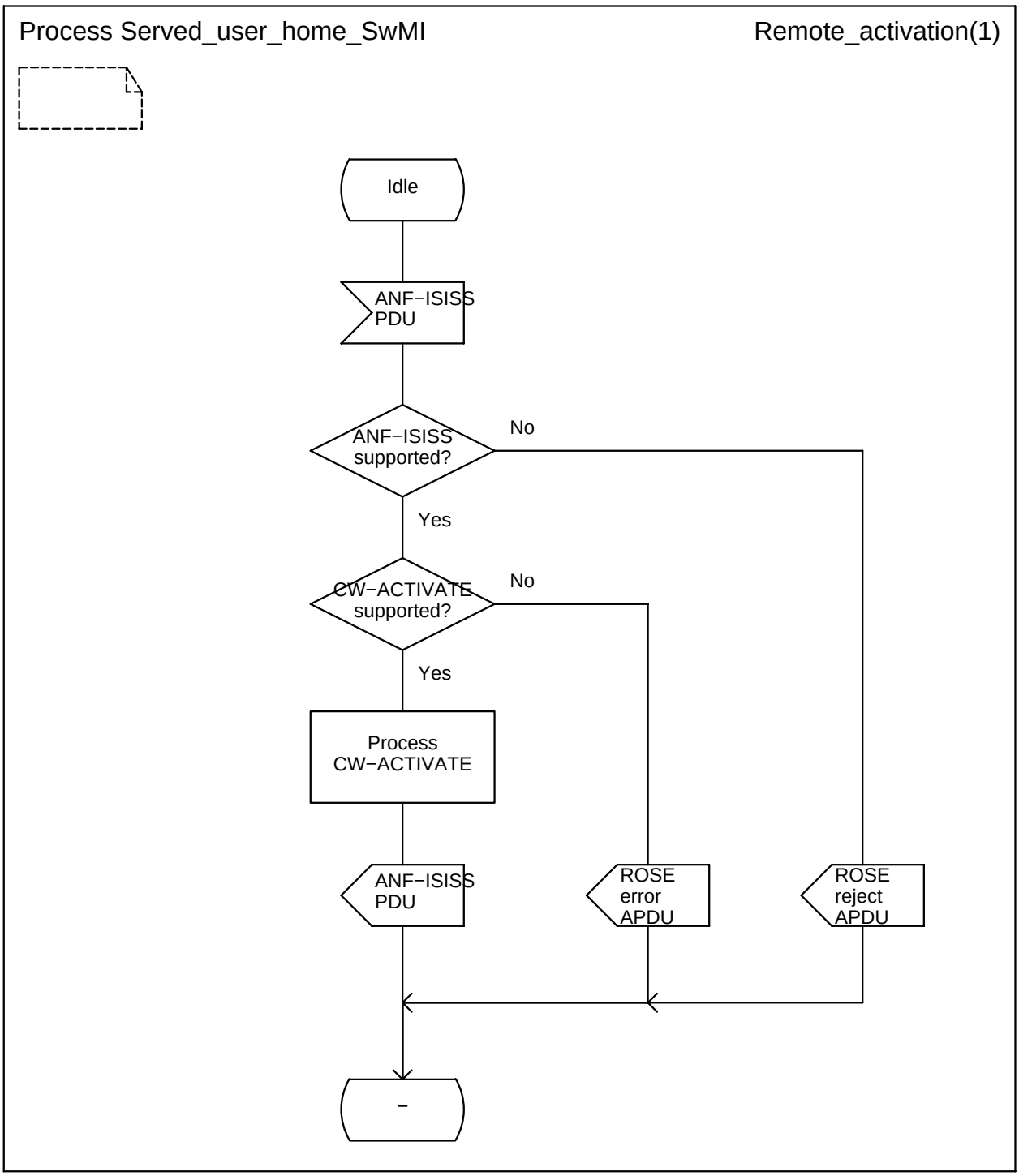
Figure B.3c (sheet 3 of 3): New served user SwMI SDL - MIGRATION PDU reception follow-up

B.4 SDL representation of SS-CW at the served user home SwMI

Figure B.4 shows the behaviour of the supplementary service control entity specific to the served user home SwMI.

The input signal from the left represents a PDU received from the served user SwMI.

Output signals to the left represent PDUs sent to the served user SwMI.



NOTE: Every ANF-ISISS PDU or ROSE APDU is conveyed by a PSS1 FACILITY message. The latter has not been shown in the corresponding signal symbols by lack of space.

Figure B.4: Served user home SwMI SDL

History

Document history			
September 1999	Public Enquiry	PE 9958:	1999-09-08 to 2000-01-07