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Foreword

This European Telecommunication Standard (ETS) has been produced by the Terrestrial Trunked Radio ETSI Project 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
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This document specifies the Call Forwarding supplementary services:

- Call Forwarding Unconditional (SS-CFU);
- Call Forwarding Busy (SS-CFB);
- Call Forwarding No Reply (SS-CFNRy);
- Call Forwarding Not Reachable (SS-CFNRc).

which are applicable to various basic services supported by TETRA SwMIs. Basic services are specified in ETS 300 392-2 [4].

SS-CFU, SS-CFB, SS-CFNRy and SS-CFNRc are supplementary services which apply during call establishment providing a forwarding of an incoming call to an other destination than the original destination defined by the calling user under different conditions (busy, no reply or not reachable respectively) or under no condition (unconditional).

Supplementary service specifications are produced in three stages, according to the method described in ITU-T Recommendation I.210 [2]. This Standard contains the stage 2 specifications of SS-CFU, SS-CFB, SS-CFNRy and SS-CFNRc. The stage 2 specification identifies the functional entities involved in the supplementary services and the information flows between them.

This draft ETS is applicable to circuit mode TETRA tele-services and bearer services only for all supplementary services specified in this draft ETS. This draft ETS applies also for SS-CFU to SDS (Short Data Services).

This Standard also specifies the Forwarding Counter (FC) applicable to various basic services supported by TETRA Network. FC limits the number of call forwarding that a call request may encounter during call establishment, e.g. to protect the network against indefinite looping. There is no user involved in the provision or operation of FC.

Man Machine Interfaces and charging principles are outside the scope of this draft ETS.

This first edition of this ETS is based on the latest published text of ECMA-173 [1]. Additions/changes to ECMA-173 [1] have been made to take into account particular TETRA specifics such as group calls and to include situations such as Not Reachable not addressed in ECMA-173 [1].

NOTE 1: Contrary to ECMA-173 [1], this ETS does not specify SS-CD (Call Deflection) which is not supported by TETRA.

NOTE 2: Contrary to ECMA-173 [1], this draft ETS distinguishes between No Reply and Not Reachable because of the radio nature of the TETRA links.

2 Normative references

This draft 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] ECMA-173 (1997): "Private Integrated Services Network (PISN) - Specification, Functional Model and Information Flows - Call Diversion Supplementary Services (CFSD)".

[2] ITU-T Recommendation I.210 (1993): "Principles of telecommunication services supported by an ISDN and the means to describe them".

[3] ITU-T Recommendation Z.100 (1993): "CCITT Specification and description language (SDL)".

[4] ETS 300 392-2 (1995): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

[5] ETS 300 392-12-4 (1998): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 12: Supplementary services stage 3; Sub-part 4: Call Forwarding".

[6] ETS 300 392-11-1 (1998): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 11: Supplementary services stage 2; Sub-part 1: Call Identification (CI)".

[7] CCITT Recommendation Q.9 (1988): "Vocabulary of switching and signalling terms".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of this ETS the following definitions apply:

Additional network feature: Additional Network Feature (ANF) is a capability, over and above that of a basic service, provided by a SwMI, but not directly to a SwMI user.

Busy: TETRA destination is considered to be busy if either a "network determined user busy" or a "user determined user busy" condition exists.

Call, basic call: call or basic call is an instance of the use of a basic service.

Connected number: number of the user that answers (User C).

Forwarded-to number: forwarded-to number is the number to which a call is forwarded.

Forwarded-to user: forwarded-to user is the user to which a call is forwarded.

Forwarding: forwarding is the redirection of a call, on behalf of a called user and prior to answer, to a number different from the number of that called user.

Forwarding from Alert: forwarding from Alert is the type of forwarding invoked from an alerting state.

NOTE 1: Forwarding from Alert can occur as a result of the supplementary services CFNRy as specified in this Standard.

Forwarding Type: forwarding type is a parameter which contains the reason for the forwarding: CFU, CFB, CFNRy, or CFNRc.

Forwarding Immediate: forwarding immediate is the type of forwarding invoked prior to reaching the alerting state.

NOTE 2: Forwarding Immediate can occur as a result of the supplementary services CFB and CFU as specified in this Standard.

Forwarding number: forwarding number is the number of the served user.

Forwarding user: user for which the call forwarding is invoked; it may be the called user first and then any of the successive forwarded-to users (see also last forwarding user).

Forward switching: network routeing algorithm which performs the forwarding by joining together the first connection from User A's node to User B's node and a second, new connection from User B's node to User C's node.

Forwarding counter: counter for the number of call forwarding involved in a call or signalling connection during the establishment phase.

Last forwarding user: last forwarding user is the served user from the point of view of the forwarded-to user for a particular stage of call forwarding. In the case of a call subject to a single stage of call forwarding, User B is the last forwarding user from the point of view of User C. In the case of a call subject to multiple stages of call forwarding, user B1 is the last forwarding user from the point of view of user B2, user B2 is the last forwarding user from the point of view of user B3, etc. The served user for the final stage of call forwarding is the last forwarding user from the point of view of User C.

Line Station (LS): physical grouping that contains all the fixed equipment that is used to obtain TETRA services through a line.

Mobile Station (MS): physical grouping that contains all of the mobile equipment that is used to obtain TETRA services. By definition, a mobile station contains at least one Mobile Radio Stack (MRS).

Original called number: original called number is the number of User B (in case of multiple call forwarding user B1).

Original called user: original called user is the first served user of a call which is subject to one or more stages of call forwarding, i.e. User B or B1.

Partial re-routeing: network routeing algorithm which performs the call forwarding by replacing a particular part of the connection from User A's node to User B's node by another connection from User A's node to User C's node.

Signalling connection: connection used to exchange information between peer supplementary service protocol control entities independently of a basic call.

supplementary service: any service provided by a network in addition to its basic service or services (defined in CCITT Recommendation Q.9 [7]). A supplementary service modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a stand alone service. It must be offered together with or in association with a basic telecommunication service (excerpt from ITU-T Recommendation I.210 [2]).

Switching and Management Infrastructure (SwMI): all of the TETRA equipment for a Voice plus Data (V+D) network except for subscriber terminals. The SwMI enables subscriber terminals to communicate with each other via the SwMI.

SwMI number: SwMI number is a number belonging to a SwMI numbering plan (ITSI or GTSI).

Re-routeing: network routeing algorithm which performs the call forwarding by replacing the connection from User A's node to User B's node by another connection from User A's node to User C's node.

Served user: served user is the user of a particular SwMI number who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or the called user.

tele-service: type of telecommunications service that provides the complete capability, including terminal equipment functions, for communication between users according to agreed protocols.

User A: user A is the calling user of a call which is subject to call forwarding.

User B: user B is the served (forwarding) user of a call which is subject to call forwarding.

User B1, user B2, user B3, etc.: these are the served (forwarding) users of a call which are subject to multiple stages of forwarding. B1 is the first served user, B2 is the second served user, B3 is the third served user, etc.

NOTE 3: B2 is also the forwarded-to user with respect to the first stage of call forwarding, B3 is also the forwarded-to user with respect to the second stage of call forwarding, etc.

User C: user C is the forwarded-to user with respect to the final stage of call forwarding.

3.2 Symbols

For the purposes of this ETS, there are no other symbols than those defined by SDL ITU-T Recommendation Z.100 [3].

3.3 Abbreviations

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

ANF	Additional Network Feature
FC	Forwarding Counter
GTSI	Group TETRA Subscriber Identity
ISDN	Integrated Services Digital Network
ISI	Inter System Interface
ITSI	Individual TETRA Subscriber Identity
LS	Line Station
MS	Mobile Station
PINX	Private Integrated Services Network Exchange
SDL	Specification and Description Language
SS	Supplementary Service

NOTE: The abbreviation SS is only used when referring to a specific supplementary service.

SwMI	Switching and Management Infrastructure
TC	Transit Counter
TE	Terminal Equipment
V+D	Voice Plus Data

3.3.1 Supplementary service abbreviations

CF	Call Forwarding
CF	Call Forwarding
CFB	Call Forwarding on Busy
CFNR	Call Forwarding on No Reply (generic for both CFNRy and CFNRc)
CFNRc	Call Forwarding on Not Reachable
CFNRy	Call Forwarding on No Reply
CFU	Call Forwarding Unconditional
COLP	COnnected Line Identification Presentation
DL	Discreet Listening
IC	Include Call

4 SS-CF Specification

This clause defines the stage 2 of the Call Forwarding supplementary services (CFU, CFB, CNFRy and CFNRc) using either the "re-routeing" network routeing algorithm or the "forward switching" network routeing algorithm. The term CF used here indicates that unless otherwise noted, the specification applies to all four supplementary services.

Different types of call forwarding (e.g. CFU, CFB, CFNRy and CFNRc) may be concatenated during multiple call forwarding as well as different network routeing algorithms (call forwarding by "forward switching" and call forwarding by "re-routeing").

4.1 Case of Re-routeing

4.1.1 Functional model

4.1.1.1 Functional model description

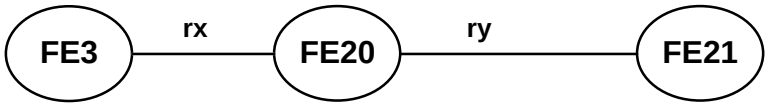
4.1.1.1.1 SS-CF management

The functional model shall comprise the following Functional Entities (FEs) for managing SS-CF in the case where the authorized user is different from the served user:

- FE20: Managed user/group home SwMI FE;
- FE3: Authorized user's functional entity;
- FE 21: See sub clause 4.1.1.1.2.

The relationship rx shall exist between FE3 and FE20 and the relationship ry shall exist between FE20 and FE21.

Figure 1 shows these FEs and relationship for the management part of SS-CF.



NOTE 1: In the case of local call forwarding, FE20 is collocated with FE21 and route ry is internal to FE21.

NOTE 2: All requests issued by the authorized user for an SS-CF managed user or group are to be addressed to the home SwMI of this managed user or group. If the managed user has migrated to another SwMI or if the group is attached in other SwMIs than the group home SwMI, ANF-ISIMM will update these SwMIs. So there is no need to show any managed user visited SwMI FE.

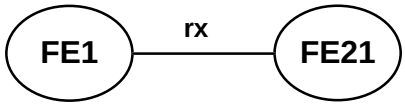
Figure 1: Functional model for the management part of SS-CF

The functional model shall comprise the following Functional Entities (FEs) for managing SS-CF in the case where the authorized user is the served user:

- FE1: Authorized user's functional entity;
- FE 21: See sub clause 4.1.1.1.2.

The relationship rx shall exist between FE1 and FE21.

Figure 2 shows these FEs and relationship for the management part of SS-CF.



NOTE 1: In the case of local call forwarding, FE20 is collocated with FE21 and route ry is internal to FE21.

NOTE 2: All requests issued by the authorized user for an SS-CF managed user or group are to be addressed to the home SwMI of this managed user or group. If the managed user has migrated to another SwMI or if the group is attached in other SwMIs than the group home SwMI, ANF-ISIMM will update these SwMIs. So there is no need to show any managed user visited SwMI FE.

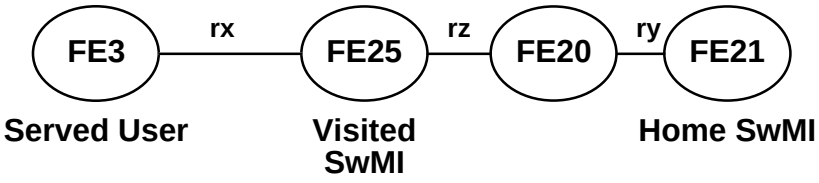
Figure 2: Functional model for the management part of SS-CF

In the case where the called/served user is not registered in its home SwMI, in particular when registered in the calling user SwMI, the functional model for the management part of SS-CF is modified as shown in Figure 3.

In that case, relationships rz shall be added between the visited SwMI FE25 and FE20.

NOTE 1: This model allows the served user home SwMI to authorize or not a change of profile request by the called/served user when that user is in a visited SwMI different from home SwMI.

NOTE 2: While the figure is shown with FE25 (most likely case), its extension to any visited SwMI different from the calling user SwMI is not excluded.



NOTE 1: In the case of local call forwarding, FE20 is collocated with FE21 and route ry is internal to FE21.

NOTE 2: This model holds only for the served/called user, not for any authorized user; this model holds only in the case where the called/served user is outside its home SwMI.

NOTE 3: This model holds independently of the routeing mechanism, re-routeing or forward switching.

Figure 3: Functional model for the management part of SS-CF

4.1.1.1.2 Forward Counter

The functional model shall comprise the following functional entities:

- FE21: FC Initialize;
- FE2x: FC Execute.

The following functional relationship shall exist between these FEs:

- ra between FE21 and FE2x and between consecutive FE2xs.

Figure 4 shows these FEs and relationship.

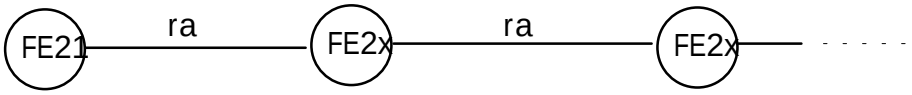


Figure 4: Functional model for FC

4.1.1.1.3 Individual Calls

The functional model for Individual Calls shall comprise the following functional entities (FEs):

- FE5: Calling user's service agent;
- FE25: Calling user's service control entity; call forwarding control entity;
- FE21: Call forwarding detection and control entity;
- FE1: Served user's service agent;
- FE26: Diverted-to user's service control entity;
- FE6: Diverted-to user's service agent.

The following functional relationships shall exist between these FEs:

- ra: between FE5 and FE25;
- rb: between FE25 and FE21;
- rc: between FE21 and FE1;
- rd: between FE25 and FE26;
- re: between FE26 and FE6;
- ry: between FE21 and FE20;
- rx: between FE20 and FE3.

4.1.1.1.2.1 Single stage of call forwarding

Figure 5 shows the FEs and relationships for a single stage of call forwarding, individual call and re-routeing.

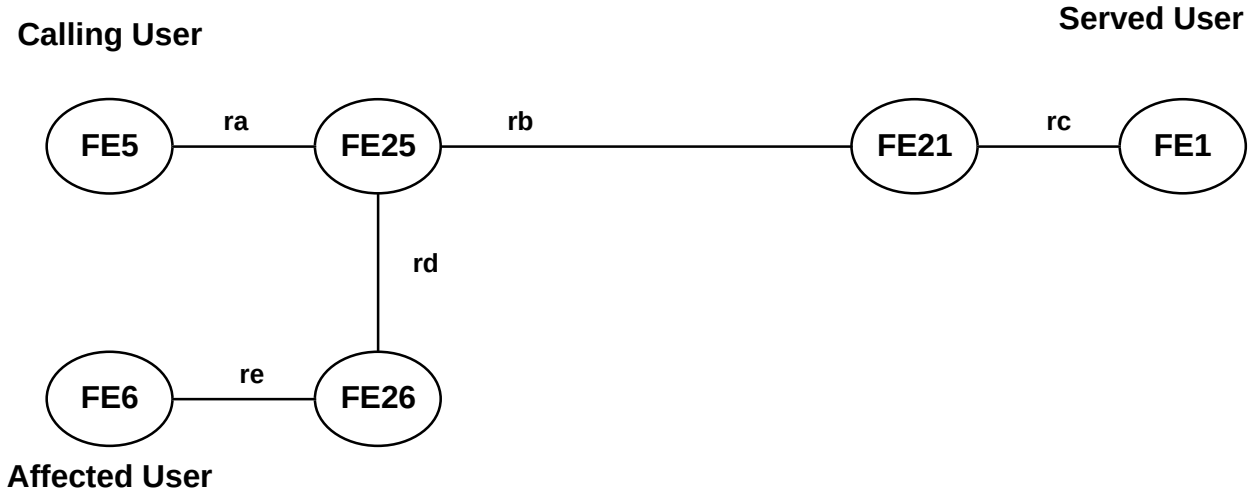


Figure 5: Functional Entity Model for Individual Call, Single Stage of Call Forwarding and Re-Routeing.

4.1.1.1.2.2 Double stage of call forwarding

Figure 6 shows the FEs and relationships for two stages of call forwarding, individual call and re-routeing.

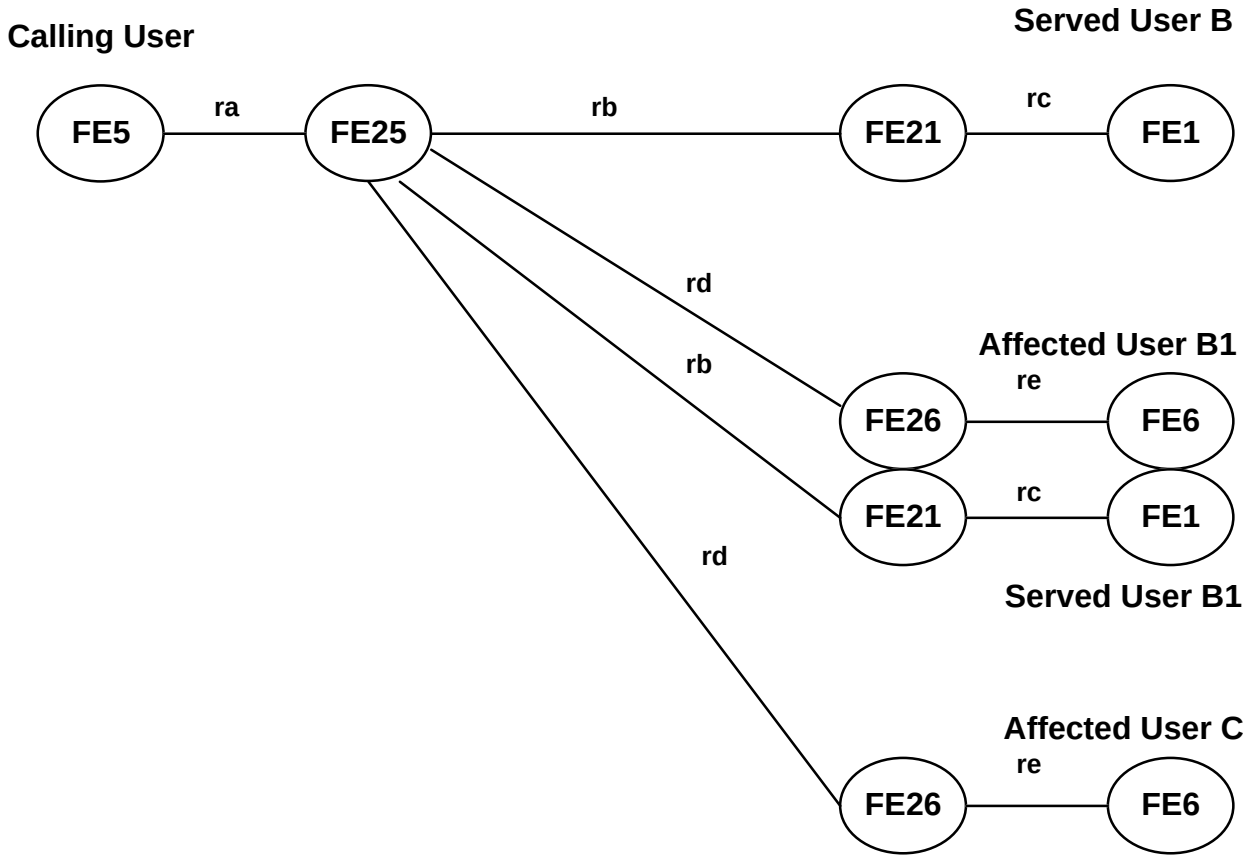


Figure 6: Functional Entity Model for Individual Call, Two Stages of Call Forwarding and Re-Routeing

4.1.1.1.4 Group Calls

The functional model for Group Calls shall comprise the following functional entities (FEs):

- FE5: Calling user's service agent;
- FE25: Calling user's service control entity; call forwarding control entity;
- FE21: Call forwarding detection and control entity;
- FE1: Served user's service agent;
- FE26: Diverted-to user's service control entity;
- FE6: Diverted-to user's service agent;
- FE22: Group controlling Functional Entity;
- FE22B: Served group controlling Functional Entity (forwarding group);
- FE22C: Affected group controlling Functional Entity (forwarded-to group).

The following functional relationships shall exist between these FEs:

- ra: between FE5 and FE25;
- rb: between FE25 and FE22 (Group Call, Re-routeing, one stage) or FE25 and FE22B (Group Call, Re-routeing, two stages);
- rd: between either FE25 and FE26 in case of re-routeing (group call re-routed to an ITSI), FE25 and FE22C (B1, B2,…) in case of group call forwarded to another GTSI (case of re-routeing);
- re: between FE26 and FE6.

NOTE: Management routes rx and ry are the same as for individual calls.

4.1.1.1.3.1 Group call, single stage of call forwarding, forwarding to another group

Figure 7 shows the FEs and relationships for a single stage of call forwarding, group call forwarded to another group GTSI and re-routeing.

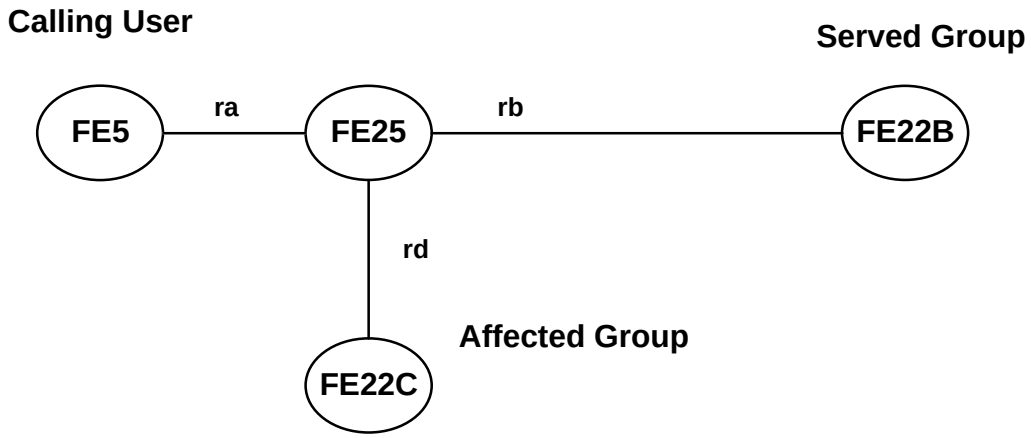


**Figure 7: Functional Entity Model for Group Call,
Single Stage of Call Forwarding and Re-Routeing**

4.1.1.1.3.2 Group call, single stage of call forwarding, forwarding to an ITSI

Figure 8 shows the FEs and relationships for a single stage of call forwarding, group call forwarded to an individual ITSI and re-routeing.

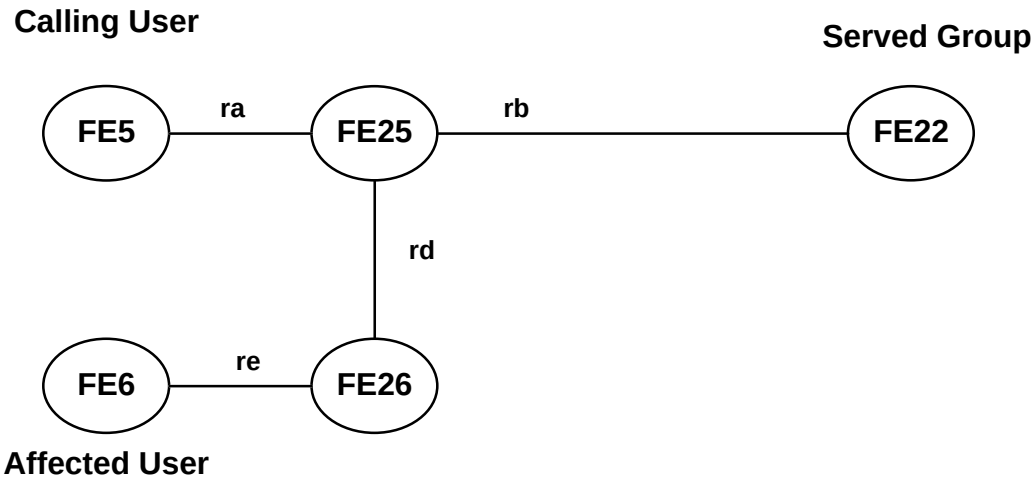
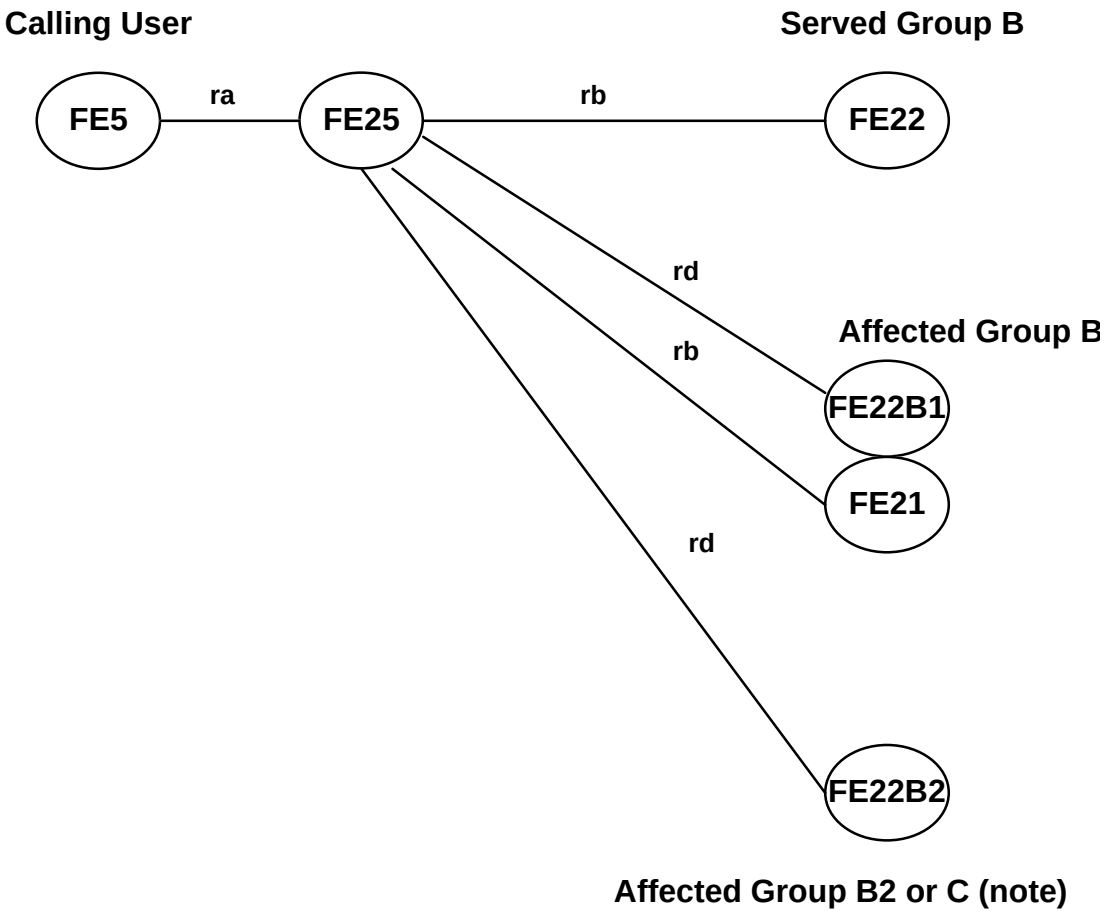


**Figure 8: Functional Entity Model for Group Call,
Single Stage of Call Forwarding (to an ITSI) and Re-Routeing**

4.1.1.1.3.3 Group call, double stage of call forwarding, forwarding to other groups

Figure 9 shows the FEs and relationships for two stages of call forwarding, group call forwarded to another group and re-routeing.

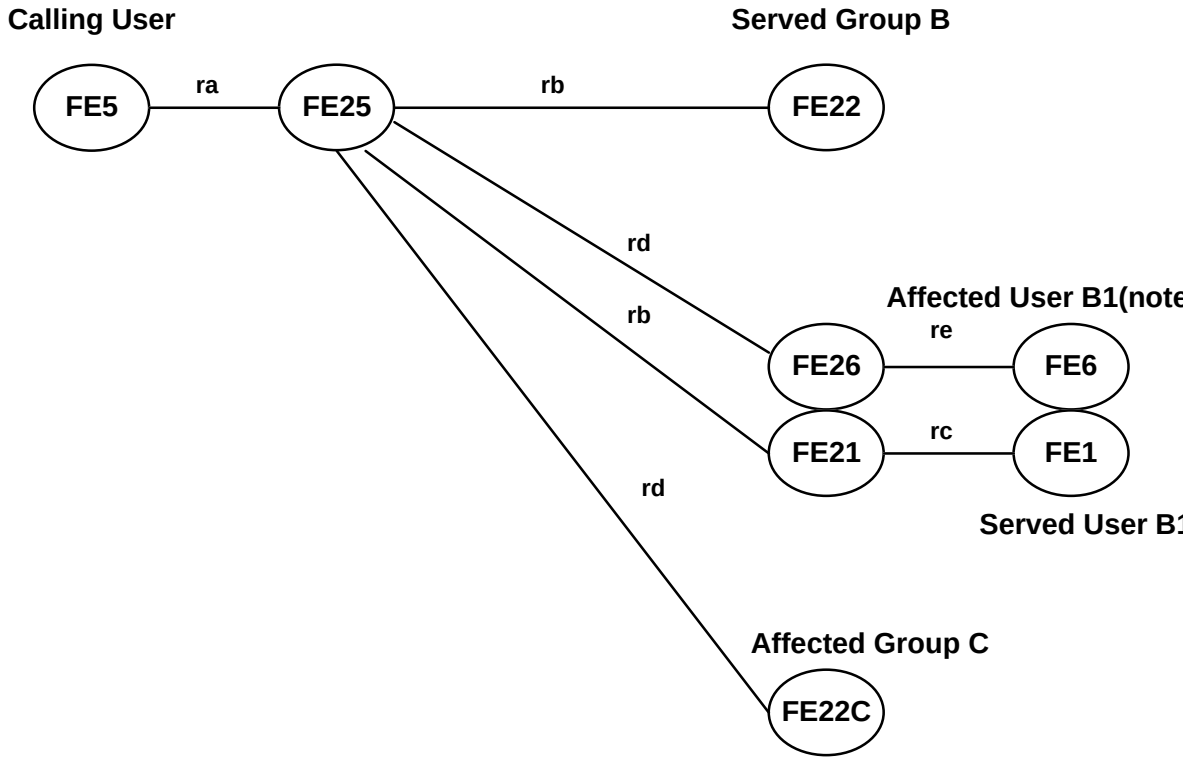


NOTE: C if last forwarded-to group.

**Figure 9: Functional Entity Model for Group Call,
Two Stages of Call Forwarding and Re-Routeing towards a group**

4.1.1.1.3.4 Group call, double stage of call forwarding, forwarding to an ITSI followed by forwarding to a group

Figure 10 shows the FEs and relationships for two stages of call forwarding, group call forwarded to an individual ITSI and re-routeing.



NOTE: The call to a group is assumed to be forwarded first to an individual user in this figure.

Figure 10: Functional Entity Model for Group Call, Two Stages of Call Forwarding and Re-Routeing to an ITSI followed by call forwarding to a group.

4.1.1.2 Description of the functional entities

4.1.1.2.1 Served user service agent, FE1

This FE detects a call forwarding request by the served user and passes that request to FE21.

4.1.1.2.2 Served user service control entity; call forwarding detection; forward counter initialize FE21

This FE detects a call forwarding request and supervises this request. FE21 provides a notification to FE25 and provides call forwarding information to FE25 in the case of re-routeing. FE 21 also receives activation, deactivation and interrogation requests from FE20 and provides responses to FE20. FE21 is responsible for modifying data related to activation, deactivation and authorized user activation/deactivation enabling and disabling. This FE also recognizes the invocation of FC, sets the forwarding counter to its initial value and passes it to FE2x.

4.1.1.2.3 FC Execute, FE2x

This FE receives the transit counter from FE21 or from another FE2x. The following two types of FE2x exist.

4.1.1.2.4 Intermediate FE2x

An intermediate FE2xcompares the transit counter to the allowed limit. If below the limit, FE2xincrements the transit counter and passes it to the next FE2; otherwise it requests rejection of the call request.

4.1.1.2.5 Final FE2x

The final FE2x terminates FC.4.1.1.2.3 Managed user/group activation, deactivation, interrogation control, FE20.

If the optional activation/deactivation procedure is supported by the home SwMI of the managed user/group, FE20 shall receive SS-CF activation/deactivation requests from FE3. FE20 shall then check them and if they are found authorized and correct, it shall make the definitions available to the relevant FE (FE21, FE25 or FE22) and shall confirm the completion of the service to FE3. If not, FE20 shall reject the activation/deactivation request and inform FE3.

The same shall apply for the optional interrogation procedure if they are supported by the home SwMI(s) of the managed user(s)/group for these procedures.

This FE relays activation, deactivation and interrogation requests and responses between FE25 and either FE21 in the case of forward switching or FE25 in case of re-routeing.

NOTE: The managed user may not be the same MS/LS for the activation/deactivation procedure and for the interrogation procedure. and may be either different or identical to the served user.

4.1.1.2.6 Authorized user/group activation, deactivation, interrogation agent, FE3

If the activation/deactivation and/or interrogation procedures are supported by the authorized user MS/LS, FE3 shall send SS-CF activation/deactivation or interrogation requests to FE20. FE3 may perform local checks for the requests before sending those requests if it finds them valid. If FE3 rejects a request, it shall indicate it to the user application. At the reception of the response from FE20, FE3 shall forward the result to the user application.

This FE3 provides activation, deactivation and interrogation requests to FE20 and delivers corresponding responses to the requesting user.

NOTE: The authorized user may be either different or identical to the served user.

4.1.1.2.7 Calling user's service agent, FE5

This FE delivers the call forwarding notifications to the calling user.

4.1.1.2.8 Calling user's service control entity; call forwarding execution entity, FE25

This FE provides the appropriate call forwarding notifications to FE5 according to the information received from FE21, FE22 and/or FE26 and according to the subscription options of SS-CF. In the case of re-routeing, this FE executes call forwarding by initiating a new call establishment, and requesting release of the leg to the original called user.

4.1.1.2.9 Forwarded-to user service agent, FE6

This FE receives from FE26 call forwarding notifications and delivers them to the forwarded-to user.

4.1.1.2.10 Forwarded-to user service control entity, FE26

This FE provides appropriate call forwarding notifications received from FE26 to FE6 and provides also number presentation restriction information to FE25 via FE21.

4.1.1.2.11 Group controlling entity, FE22

This FE fulfills the same functions as FE21 (case of re-routeing).

NOTE: The mode of operation defined for TETRA Group Call is re-routeing and only re-routeing.

4.1.1.3 Relationship of functional model to basic call functional model

Functional entity FE5 shall be collocated with calling user A's CCA.

Functional entity FE25 shall be collocated with calling user A's CC or with any Incoming Gateway CC or any Forwarding CC in the case of call forwarding by re-routeing.

Functional entity FE21 shall be collocated with served user B's CC (users B1 ... Bn in case of multiple call forwarding) in the case of call forwarding by forward switching. Functional entity FE21 shall be collocated with served user B's CC in the case of re-routeing.

Functional entity FE1 shall be collocated with served user B's CCA (users B1 … Bn in case of multiple call forwarding) in the case of call forwarding by forward switching. Functional entity FE1 shall be collocated with served user B`s CCA in the case of re-routeing.

Functional entity FE26 shall be collocated with forwarded-to user C's CC, and also with the CCs for forwarded-to users B2 ... Bn in case of multiple call forwarding.

Functional entity FE6 shall be collocated with forwarded-to user C's CCA, and also with the CCAs for forwarded-to users B2, …, Bn in case of multiple call forwarding.

Functional entity FE22 shall be collocated with served group B's CC.

Being call unrelated, the activation/deactivation and interrogation procedures are independent from CC or CCA.

One example of the relationships with a basic service is shown in figure 11.

This example is used as the basis for the information flow sequence diagrams in subclause 4.1.2.2.

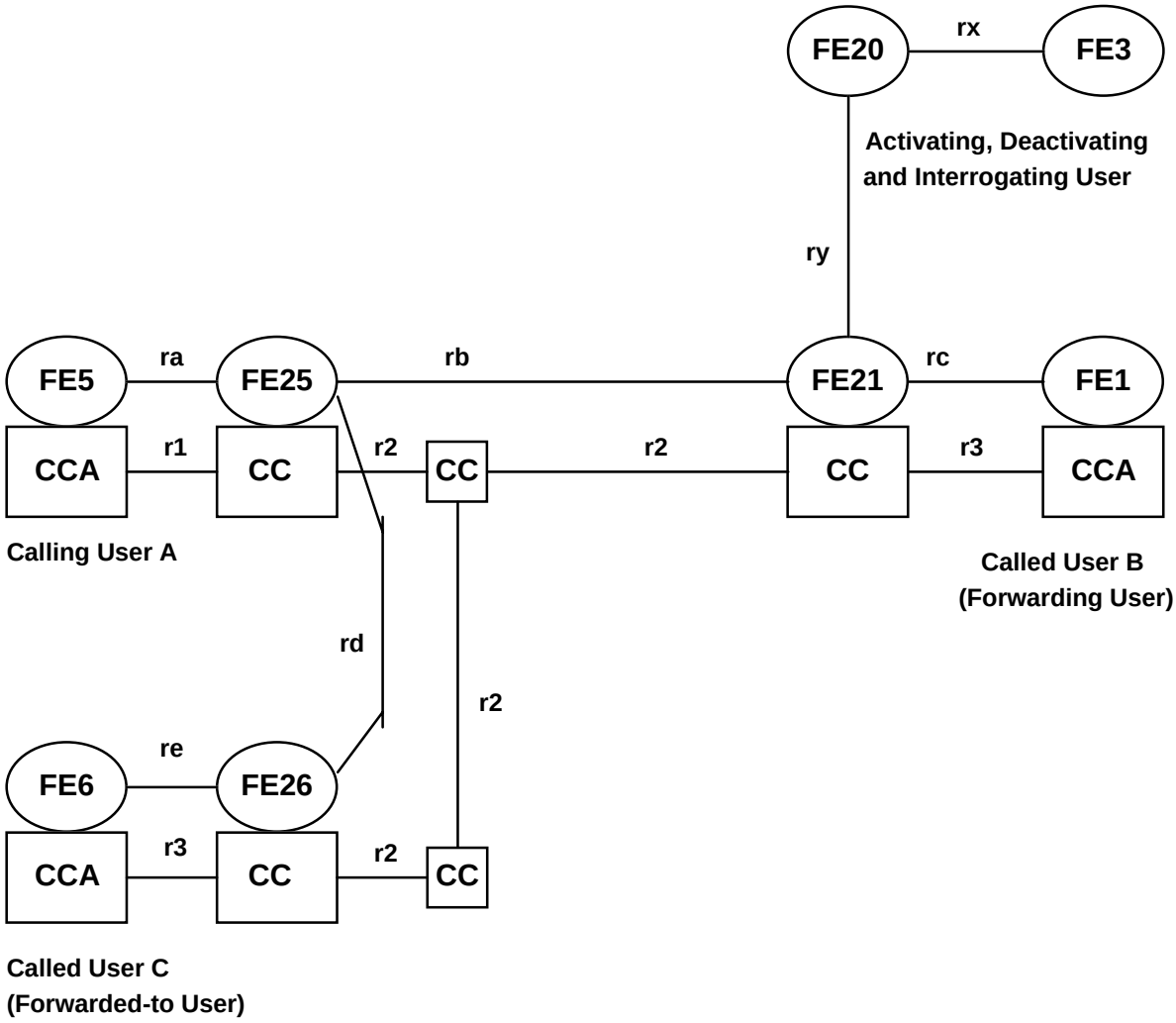


Figure 11: Functional Entity Model Relationship in Case of Individual Call, Single Stage Call Forwarding and Re-Routeing

4.1.1.4 Relationship of functional model of Forwarding Counter to basic call functional model

FE21 shall be collocated with the Originating CC, an Incoming Gateway CC, or a Forwarding CC.

An intermediate FE2x shall be collocated with a Transit CC.

The final FE2x shall be collocated with the Terminating CC or an Outgoing Gateway CC.

Figure 12 shows an example of the relationship with the basic call functional model.

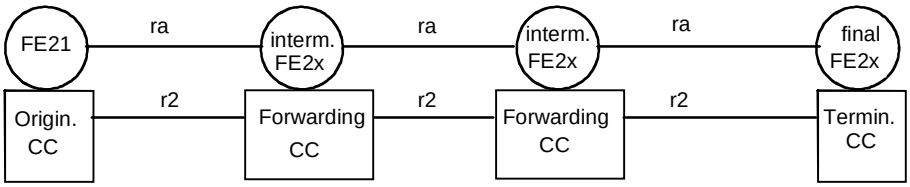


Figure 12: Example relationship between models for ANF-FC and basic call

4.1.1.5 Service primitives

This subclause lists SS-CF service primitives used to invoke or being a result of information flow sequences. The SS-CF service primitives are defined in ETS 300 392-12-4 [5], subclause 4.2 and the basic call service primitives are defined in ETS 300 392-2 [4], clause 11.

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

- INFORM 2 indication;
- INFORM 8 indication;
- INFORM 9 indication;
- ENABLE request;
- ENABLE ACK indication;
- DISABLE request;
- DISABLE ACK indication.

The SS-CF service primitives for the authorized user (including the served user) at the MS/LS TNSS-SAP shall be:

- ACTIVATE request;
- ACTIVATE ACK indication;
- DEACTIVATE request;
- DEACTIVATE ACK indication;
- INTERROGATE request;
- INTERROGATE ACK indication.

The SS-CF service primitives for the forwarded-to user at the MS/LS TNSS-SAP shall be:

- DEACTIVATE request;
- DEACTIVATE ACK indication;

  NOTE: EEC Requirement.

- INFORM 5 indication.

The SS-CF service primitive for the calling user at the MS/LS TNSS-SAP shall be:

- INFORM 7 indication.

4.1.2 Information Flows

In the tables below, the column headed "Type" indicates which of the service elements are mandatory (M) and which are optional (O) in the corresponding information flow.

4.1.2.1 Definition of information flows

4.1.2.1.1 ACTIVATE

This unconfirmed information flow activates call forwarding. It may be sent over relationships rx, relationship ry and relationship rz (in the case of individual call where the called user is not in its home SwMI) and it shall contain the service elements listed in table 1.

Table 1: Contents of ACTIVATE

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Forwarded-to User Number for Basic Service		M
Basic Service Information		M
Served User Number		C (note)
Activating User's Number		O (note)
NOTE : This service element shall only be included in the case of activation by an authorized user different from the served user.		

4.1.2.1.2 ACTIVATE ACK

This unconfirmed information flow gives the result of the ACTIVATE call forwarding. It may be sent over relationship rx, relationship ry and relationship rz and it shall contain the service elements listed in table 2.

Table 2: Contents of ACTIVATE ACK

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Forwarded-to User Number for Basic Service		M
Basic Service Information	all or a specific one	M
Served User Number		O (note 1)
Authorized User Number		O (note 1)
Activation Request Result	accepted/rejected	M
Cause for rejection	* service not subscribed * authorized user not enabled * insufficient information * no valid forwarded-to number * basic service not subscribed * served user outside its home SwMI and not authorized	C (note 2)
NOTE 1: This service element shall only be included in the case of activation by an authorized user different from the served user. NOTE 2. This service element shall only be included in case of rejection.		

4.1.2.1.3 DEACTIVATE

This unconfirmed information flow deactivates call forwarding. It may be sent over relationship rx, relationship ry and relationship rz and it shall contain the service elements listed in table 3.

Table 3: Contents of DEACTIVATE

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	all or a specific one	M
Served User Number		O (note)
Deactivating User Number		O (note)
NOTE: This service element shall only be included in the case of deactivation by an authorized user different from the served user.		

4.1.2.1.4 DEACTIVATE ACK

This unconfirmed information flow deactivates call forwarding. It may be sent over relationship rx, relationship ry and relationship rz and it shall contain the service elements listed in table 4.

Table 4: Contents of DEACTIVATE ACK

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service	all or a specific one	M
Served User's Number		C (note 1)
Deactivating User's Number		C (note 1)
Deactivation Request Result	accepted/rejected	M
Cause for rejection	* service not subscribed * authorized user not enabled * insufficient information * basic service not subscribed	O (note 2)
NOTE 1: This service element shall only be included in the case of deactivation by an authorized user different from the served user. NOTE 2: This service element shall only be included in case of rejection.		

4.1.2.1.5 DISBALE

This unconfirmed information flow disables authorized user call forwarding activation. It may be sent over relationship rc and it shall contain the service elements listed in table 5.

Table 5: Contents of DISABLE

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	all or a specific one	M
Authorized user number		M

4.1.2.1.6 DISABLE ACK

This unconfirmed information flow disables authorized user call forwarding activation. It may be sent over relationship rc and it shall contain the service elements listed in table 6.

Table 6: Contents of DISABLE ACK

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	all or a specific one	M
Authorized user number		M
Disable Request Result	accepted/rejected	M
Cause for rejection	* service not subscribed * user not enabled * insufficient information * basic service not subscribed	O (note)
NOTE: This service element shall only be included in case of rejection.		

4.1.2.1.7 ENABLE

This unconfirmed information flow enables authorized user call forwarding activation. It may be sent over relationship rc and it shall contain the service elements listed in table 7.

Table 7: Contents of ENABLE

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	all or a specific one	M
Authorized user number		M

4.1.2.1.8 ENABLE ACK

This unconfirmed information flow enables authorized user call forwarding activation. It may be sent over relationship rc and it shall contain the service elements listed in table 8.

Table 8: Contents of ENABLE ACK

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	all or a specific one	M
Authorized user number		M
Enable Request Result	accepted/rejected	M
Cause for rejection	* service not subscribed * user already enabled * insufficient information * basic service not subscribed	O (note)
NOTE: This service element shall only be included in case of rejection.		

4.1.2.1.9 FC

FC is an unconfirmed information flow across ra from FE21 to FE2x and between FE2xs.

Table 9 lists the service elements within the FC information flow. 'M' in the column headed "Request" indicates that the service element is mandatory.

Table 9: Content of FC

Service element	Allowed Value	Request
Forwarding Count	Integer (note)	M
NOTE: The allowed range is (0, .., *max*) where *max* is a network dependent maximum value.		

Service element Forwarding Count shall always be included in the FC information flow and contain the current value of the forwarding counter.

4.1.2.1.10 FORWARD

This unconfirmed information flow invokes call forwarding operation. It shall be sent over relationship rb either from FE21 to FE25 in case of individual calls or from FE22 to FE25 in case of group calls and it shall contain the service elements listed in table 10.

NOTE: As a result of the merge between ANF-ISI-IC and SS-CF for the routeing method choice, the FORWARD information flow will now belong either to ANF-ISI-IC or to ANF-ISI-GC and is recalled here for reader`s convenience.

Table 10: Contents of FORWARD

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
SS-CF Info Present	yes, no	M
Routeing Method	Re-routeing, Forward switching	M
Forwarded-to Number including restriction indicator		M
SS-CF invocation Counter		M
Originating Number		M
Notification Subscription Option:	No Yes, without number	M
Forwarding Number including restriction indicator		M
Called Number including restriction indicator		O

4.1.2.1.11 FORWARD ACK

This unconfirmed information flow gives the result of the invoke of the call forwarding operation. It shall be sent over relationship rb between either FE25 and FE21 in case of individual calls or FE25 and FE22 in case of group calls and it shall contain the service elements listed in table 11.

NOTE: As a result of the merge between ANF-ISI-IC and SS-CF for the routeing method choice; the FORWARD ACK information flow will now belong to ANF-ISI-IC and is recalled here for reader`s convenience.

Table 11: Contents of FORWARD ACK

Service elements	Allowed value	Confirm
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
SS-CF Information Present	yes, no	M
Forwarding Invocation Result	accepted/rejected	M
Routeing Method	Re-routeing, Forward switching	M

4.1.2.1.12 INFORM 1

This unconfirmed information flow indicates to FE25 that call forwarding has been initiated and informs of calling user notification restrictions (subscription options of user B). It shall only be sent in the case of forward switching. It shall be sent over relationship rb either from FE21 to FE25 in case of individual calls or from FE22 to FE25 in case of group calls and it shall contain the service elements listed in table 12.

Table 12: Content of INFORM 1

Service elements	Allowed value	Type
Notification Subscription Option	Yes, without number	M
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M

4.1.2.1.13 INFORM 2

This unconfirmed information flow indicates to FE5 that call forwarding has been initiated. It shall only be sent if required by the subscription options of user B. It shall be sent over relationship ra.

There is no service element in this information flow.

4.1.2.1.14 INFORM 4

This unconfirmed information flow indicates to FE26 that call forwarding is taking place. It shall be sent over relationship rd and it shall contain the service elements listed in table 13.

NOTE: The Forwarded-to Number (= Destination Number), Originating Number, Basic Service, Originating Category and Call History are carried in the basic call to user C and are not shown in INFORM 4. The basic call service elements are defined in ETS 300 392-2 [4].

Table 13: Content of INFORM 4

Service elements	Allowed value	Type
Last Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Original Forwarding Type	CFU, CFB, CFNRy, CFNRc	O
Forwarding Counter	0-31	M
Forwarding Number, including restriction indicator		M
Original Called Number including restriction indicator		O (note)
NOTE: This service element shall only be included in case of multiple forwarding.		

4.1.2.1.15 INFORM 5

This unconfirmed information flow indicates to FE6 that call forwarding is taking place. It shall be sent over relationship re and it shall contain the service elements listed in table 14.

NOTE: The Forwarded-to Number (= Destination Number), Basic Service, Originating Category and Call History are assumed to be carried in the basic call to user C and are not shown in INFORM 5. The basic call service elements are defined in ETS 300 392-2 [4].

Table 14: Content of INFORM 5

Service elements	Allowed value	Type
Original Forwarding Type	CFU, CFB, CFNRy, CFNRc	O (note 2)
Last Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Forwarding User Number (Served User Number)		O (note 3)
Basic Service Information	Speech, Data, Both	M
Originating User Number		O (note 1)
Original Called User Number		O (notes 2 & 3)
NOTE 1: This shall comprise service elements of information flow INFORM 2 in ETS 300 392-11-1 [6]. NOTE 2: This service element shall only be included in case of multiple forwarding. NOTE 3: This service element shall only be included if no restriction exists.		

4.1.2.1.16 INFORM 6

This unconfirmed information flow indicates whether presentation of user C's number is allowed. It shall be sent over relationship rd between either FE26 and FE25 in the case of individual calls or FE22B and FE25 in case of group calls and it shall contain the service elements listed in table 15.

Table 15: Content of INFORM 6

Service Elements	Allowed Value	Type
Presentation Indicator	present. allowed present. not allowed	M (note)
NOTE: The Presentation Indicator shall apply only to the indication of user C's number.		

4.1.2.1.17 INFORM 7

This unconfirmed information flow informs FE5 of the user C's number if appropriate. It shall only be sent if calling user has subscribed to SS-COLP and if user C's number is not presentation restricted. It shall be sent over relationship ra and it shall contain the service elements listed in table 16.

Table 16: Contents of INFORM 7

Service elements	Allowed value	Type
Forwarded-to Number for Basic Service	ITSI/GTSI/External Number number not available	M (note)
NOTE: This flow actually belongs to SS-COLP since for TETRA, the forwarded-to number is not presented to the calling user.		

4.1.2.1.18 INFORM 8

This unconfirmed information flow indicates to FE1 that CFU/CFB/CFNRy/CFNRc has been activated. It shall be sent over relationship rc and it shall contain the service elements listed in table 17.

Table 17: Contents of INFORM 8

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Forwarded-to Number for Basic Service		M
Basic Service Information	speech, data, both	M

4.1.2.1.19 INFORM 9

This unconfirmed information flow indicates to FE1 that CFU/CFB/CFNRy/CFNRc has been deactivated. It shall be sent over relationship rc and it shall contain the service elements listed in table 18.

Table 18: Contents of INFORM 9

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service	speech, data or both	M

4.1.2.1.20 INTERROGATE

This unconfirmed information flow conveys call forwarding interrogation. It may be sent over relationship rx and relationship ry and it shall contain the service elements listed in table 19.

Table 19: Contents of INTERROGATE

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	speech, data or both	M
Served User Number		M (note 2)
Interrogating User Number		O (note 1)
NOTE 1: This service element shall only be included in the case of interrogation by an authorized user different from the served user. NOTE 2: The service element shall be included over relationship ry and shall not be included over relationship rx.		

4.1.2.1.21 INTERROGATE ACK

This unconfirmed information flow conveys call forwarding interrogation. It may be sent over relationship rx and relationship ry and it shall contain the service elements listed in table 20.

Table 20: Contents of INTERROGATE ACK

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service Information	all or a specific one	M
Served User Number		O (note 1)
Interrogating User Number		O (note 1)
Interrogation Request Result	activated not activated or rejected	M
Forwarded-to Number for Basic Service		O (note 2)
Authorized User Activation/Deactivation		O (note 2)
NOTE 1: This service element shall only be included in the case of interrogation by an authorized user different from the served user. NOTE 2: This service element shall only be included if call forwarding is activated. It may be repeated, if INTERROGATE indicated "all basic services". NOTE 3: This service element shall only be included if call forwarding is activated. It may be repeated, if INTERROGATE indicated "all basic services".		

4.1.2.1.22 REPORT INVOCATION

This unconfirmed information flow conveys call forwarding invocation only in the case where called/served user is outside its home SwMI. It may be sent over relationship rb and it shall contain the service elements listed in table 21.

Table 21: Contents of REPORT INVOCATION

Service elements	Allowed value	Type
Forwarding Type	CFU, CFB, CFNRy, CFNRc	M
Basic Service	all or a specific one	M
Served User's Number		O
Served User Visited MNI		O
Forwarded-to Number for Basic Service		O

4.1.2.2 Relationship of information flows to basic call information flows

The SS-CF FC (Forward Counter) information flow shall be sent across ra in conjunction with the basic ISI-IC-SETUP request sent to establish a call.

The SS-CF INFORM 4 Indication information flow shall be sent across re in conjunction with ISI-IC-SETUP request/indication call is being forwarded.

The SS-CF INFORM 5 Indication information flow shall be sent across rf in conjunction with D-SETUP request/indication to indicate that call has been forwarded.

The SS-CF INFORM 6 Indication information flow shall be sent across ra in conjunction with the basic call D-ALERT indication sent to inform the calling user that the call being alerted has been forwarded.

The SS-CF INFORM 7 indication information flow shall be sent across ra in conjunction with the basic call information flow D-ALERT/D-CONNECT request/response in the case of successful call forwarding .

Table 22 summarizes the relationship of the SS-CF information flows to those of basic call.

Table 22 - Relationship of SS-CF information flows to Basic Call

Information flow		Independent of basic call ?	With basic call flow ?	Basic call flows:
ACTIVATE		YES	NO	
ACTIVATE ACK		YES	NO	
DEACTIVATE		YES	NO	
DEATIVATE ACK		YES	NO	
DISABLE		YES	NO	
DISABLE ACK		YES	NO	
ENABLE		YES	NO	
ENABLE ACK		YES	NO	
FC		NO	YES	ISI-IC-SETUP (note)
FORWARD		YES	NO	
FORWARD ACK		YES	NO	
INFORM 1		YES	NO	
INFORM 2		YES	NO	
INFORM 4		NO	YES	ISI-IC-SETUP (note)
INFORM 5		NO	YES	D-SETUP
INFORM 6		NO	YES	ISI-IC-ALERT (note)
INFORM 7		NO	YES	D-ALERT or D-CONNECT
INFORM 8		YES	NO	
INFORM 9		YES	NO	
INTERROGATE		YES	NO	
INTERROGATE ACK		YES	NO	
REPORT INVOCATION		YES	NO	
NOTE 1: And ISI only.				

4.1.2.3 Examples of information flow sequences

Signaling procedures shall be provided in support of the information flow sequences specified below. In addition, signaling procedures should be provided to cover other sequences arising from error situations, interactions with basic call, interactions with other supplementary services, different topologies, etc.

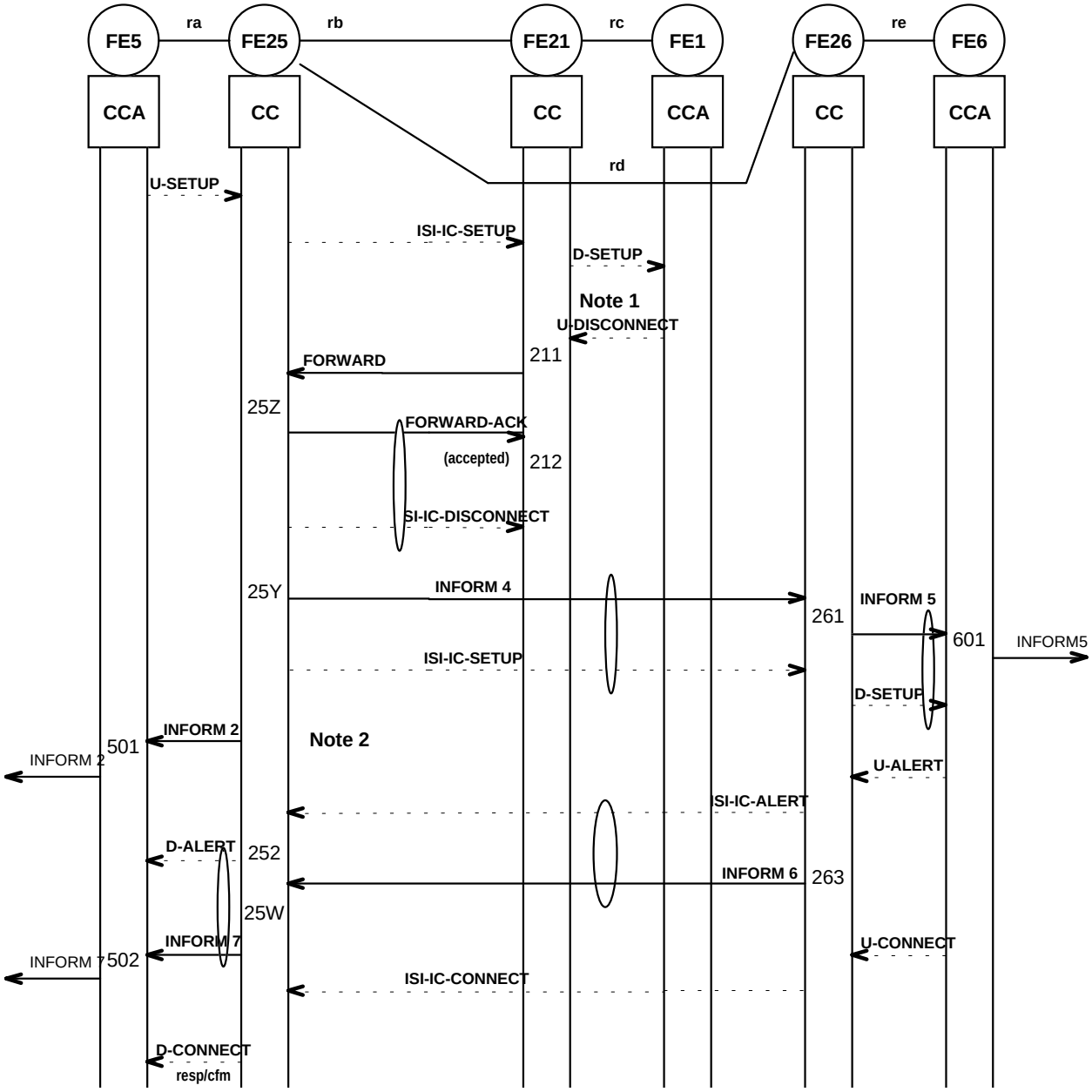
In the figures, SS-CF information flows are represented by solid arrows and basic call information flows are represented by broken arrows. An ellipse embracing two information flows indicates that the two information flows occur together. Within a column representing an SS-CF functional entity, the numbers refer to functional entity actions listed in subclause 4.3.

Basic call information flows are represented only as far as necessary for the understanding of the SS-CF procedures.

4.1.2.2.1 Case of individual call

4.1.2.2.1.1 Information flow sequences for CFU/CFB operation

The information flow sequence for successful CFU/CFB operation is shown in figure 13. The case of SS-CFB for NDUB lead to the same information flows.

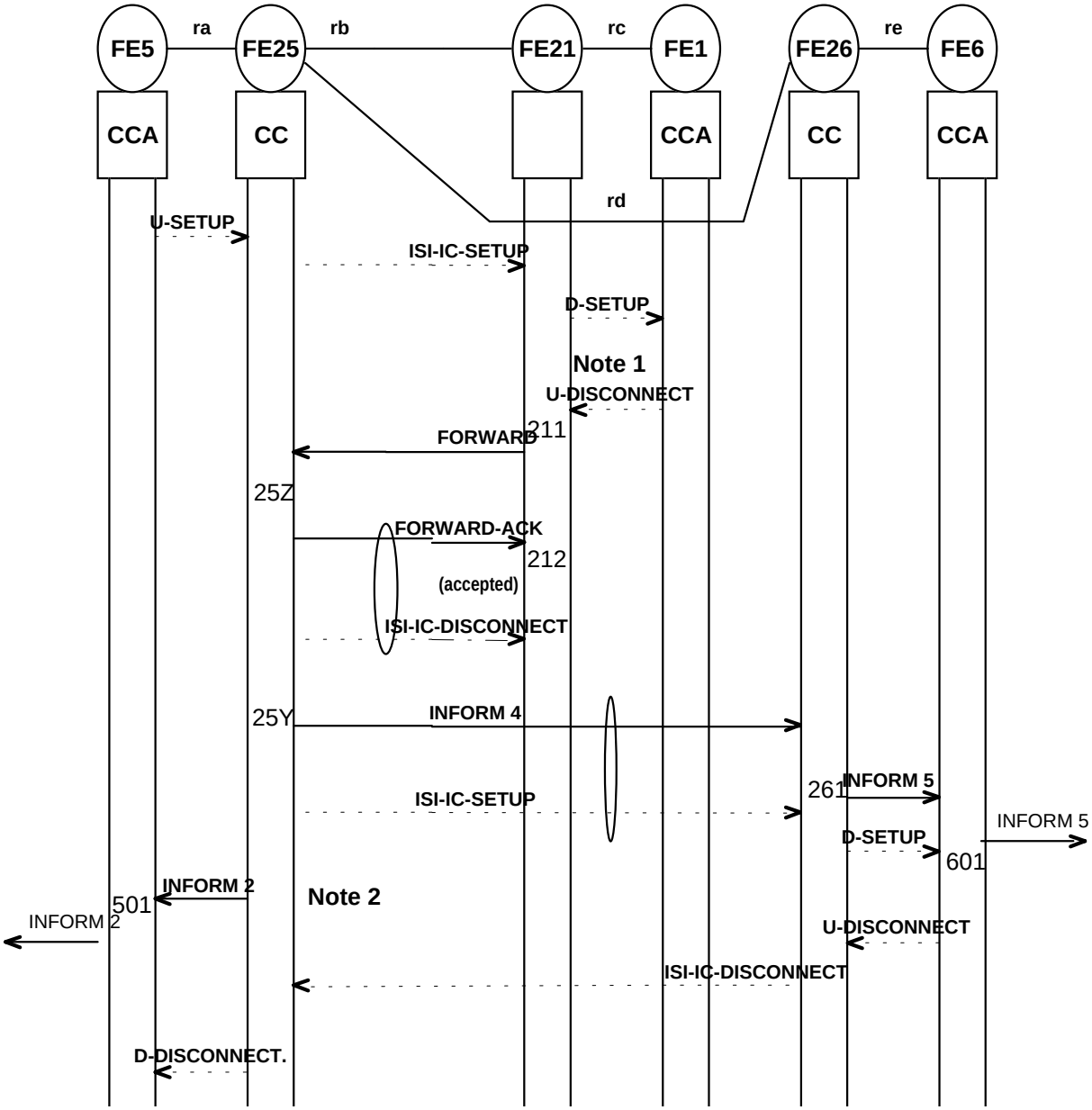


NOTE 1: This information flow is only applicable in case of CFB-UDUB.

NOTE 2: In the case of re-routeing, the information flow INFORM1 is internal to FE25.

Figure 13: Information Flow Sequence for successful CFU/CFB operation; case of re-routeing

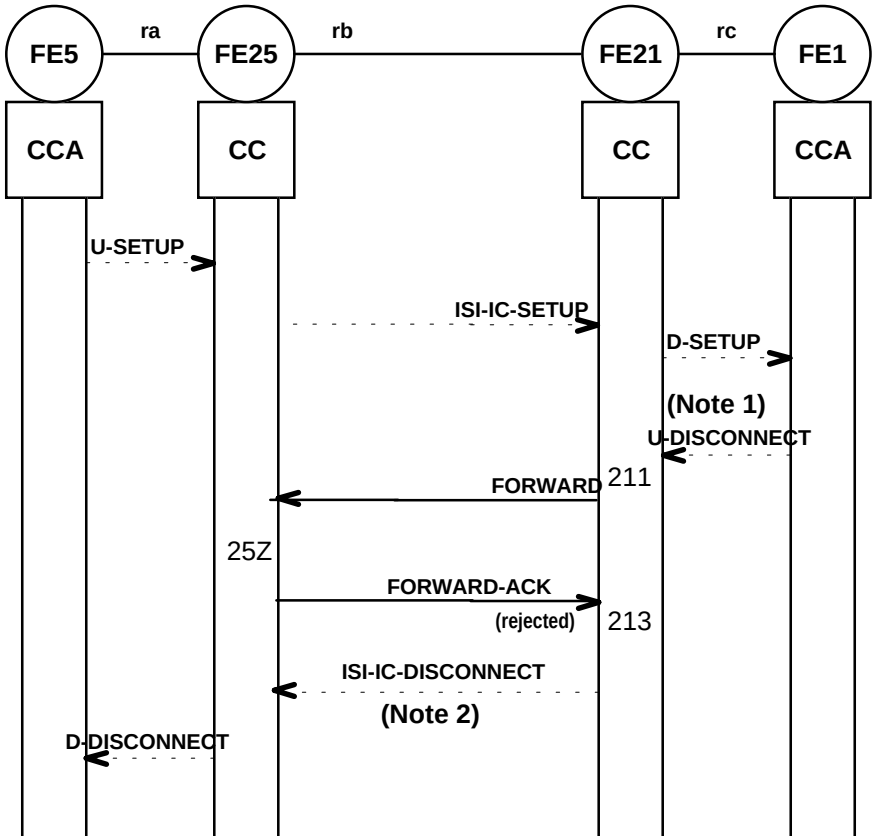
The information flow sequences for unsuccessful CFU/CFB operation are shown in figures 14 and 15.



NOTE 1: This information flow is only applicable in case of CFB-UDUB.

NOTE 2: In the case of re-routeing, the information flow INFORM1 is internal to FE25.

Figure 14: Information Flow Sequence for unsuccessful CFU/CFB operation: Failure of forwarded call; case of re-routeing



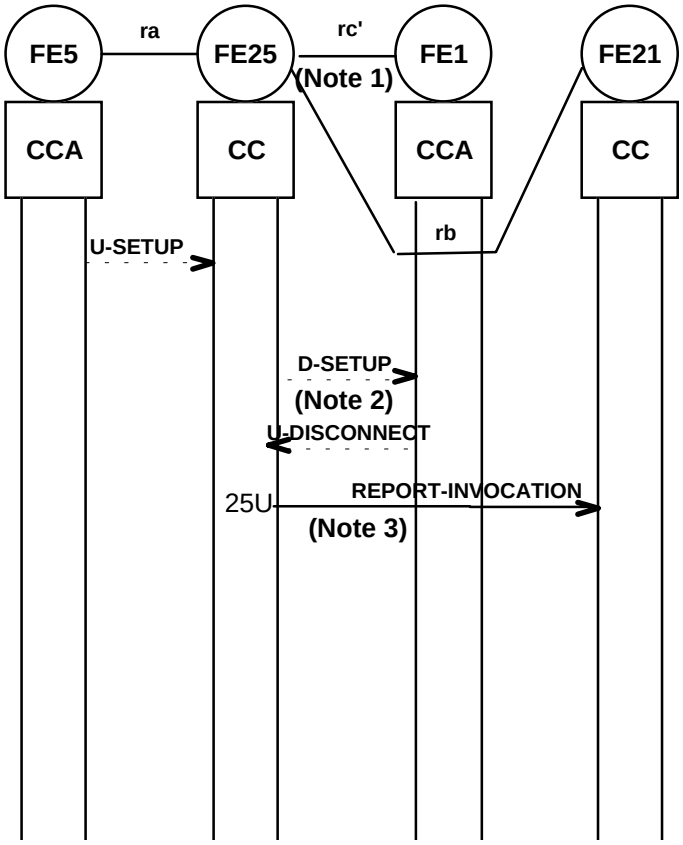
NOTE 1: This information flow is only applicable in case of CFB-UDUB.

NOTE 2: With a disconnect cause unsuccessful call forwarding.

Figure 15: Information Flow Sequences for unsuccessful CFU/CFB operation: Rejection of Call Forwarding; case of re-routeing

In the case where the called/served user is outside home SwMI, the following additional information flow shall take place as shown in Figure 16.

NOTE: The other information flows are unaffected by this information flow.



NOTE 1: The served user is in FE25.

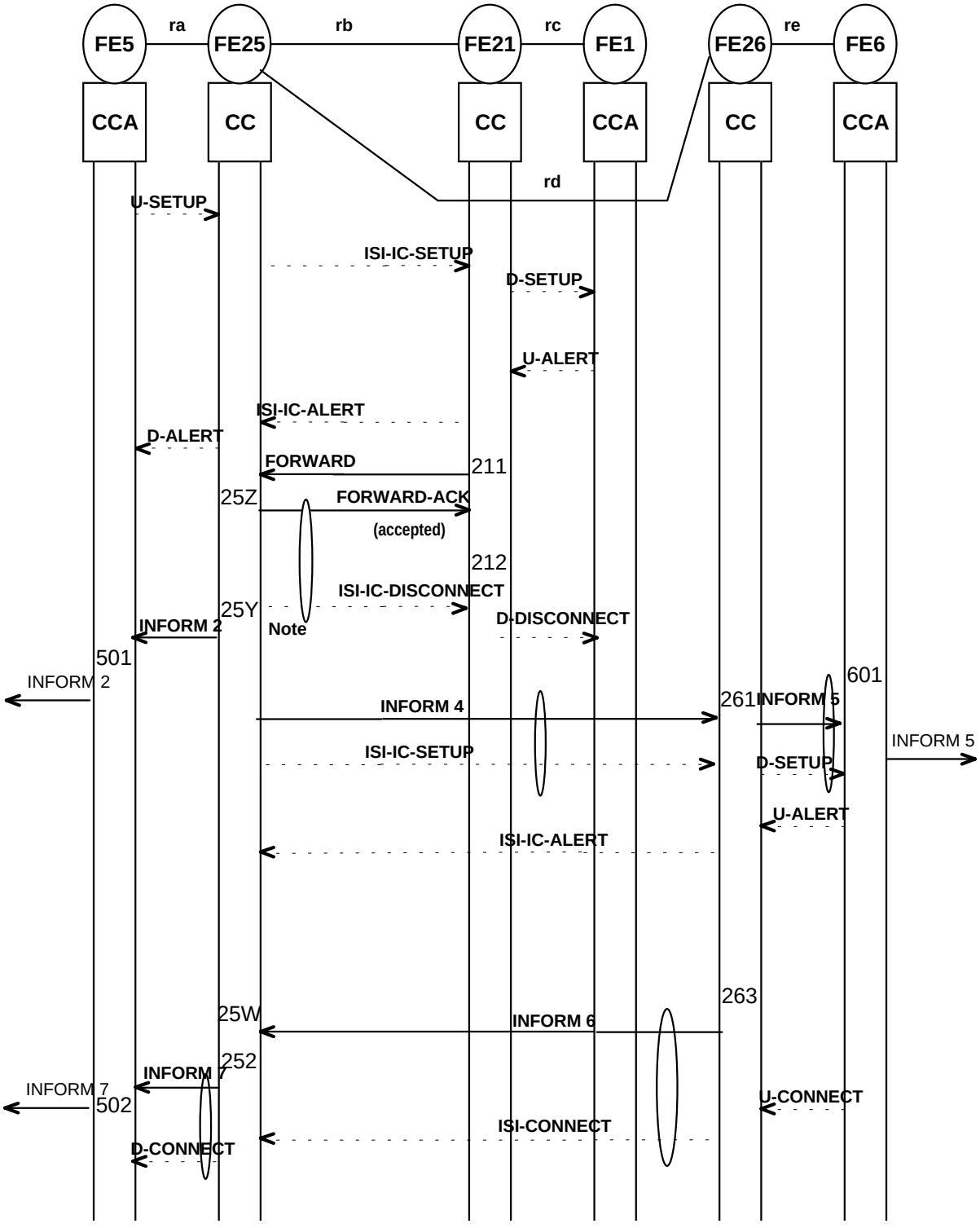
NOTE 2: This information flow is only applicable in case of CFB-UDUB.

NOTE 3: The information flow "REPORT INVOCATION" is sent regardless of the final outcome of SS-CF by the served user visited SwMI.

Figure 16: Information Flow Sequences for SS-CF invocation outside home SwMI of called/served user

4.1.2.2.1.2 Information flow sequences for CFNRy operation

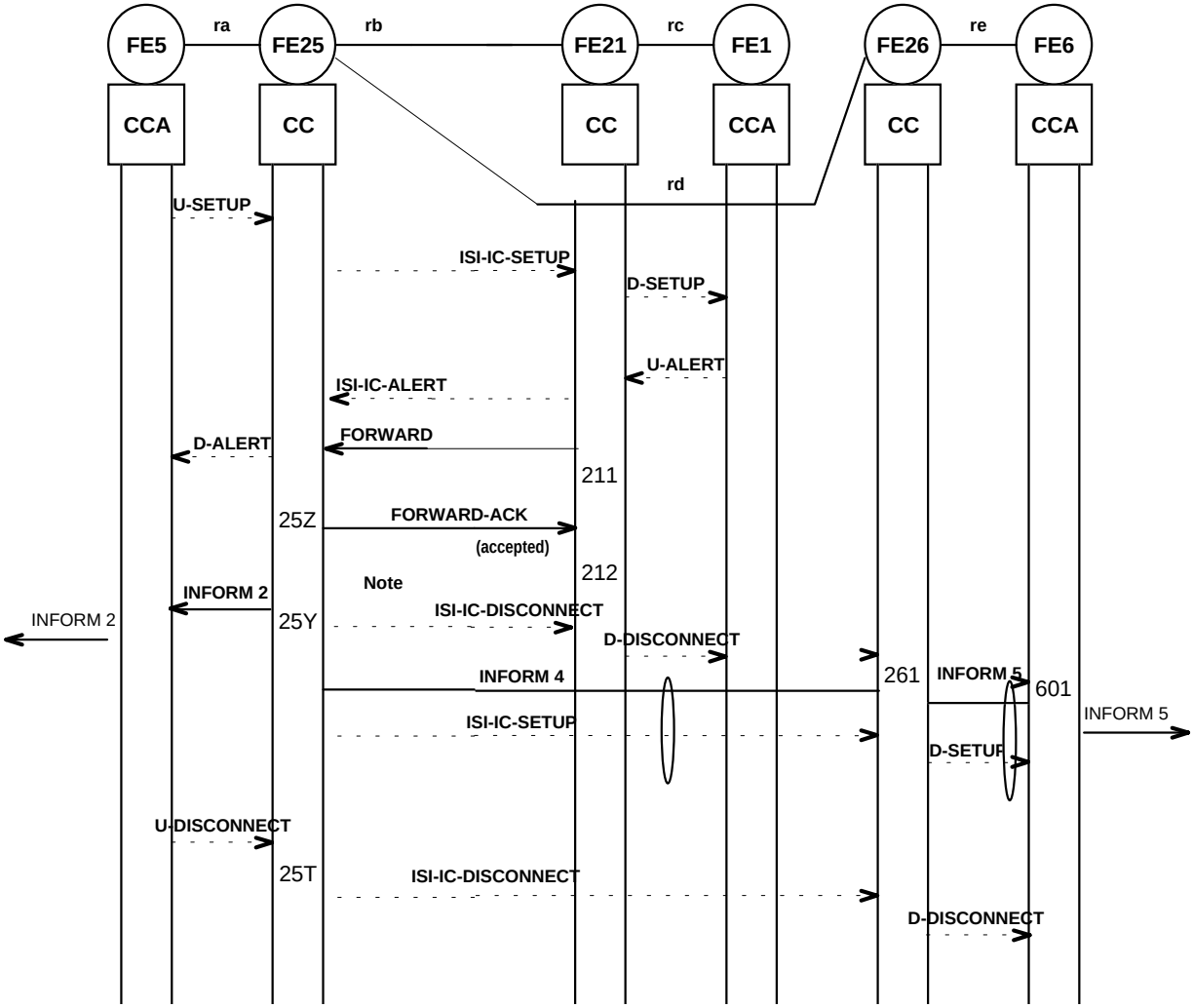
The information flow sequence for successful CFNRy operation is shown in figure 17.



NOTE: INFORM 1 is an internal flow to FE25.

Figure 17: Information Flow Sequence for successful CFNRy operation; case of re-routeing

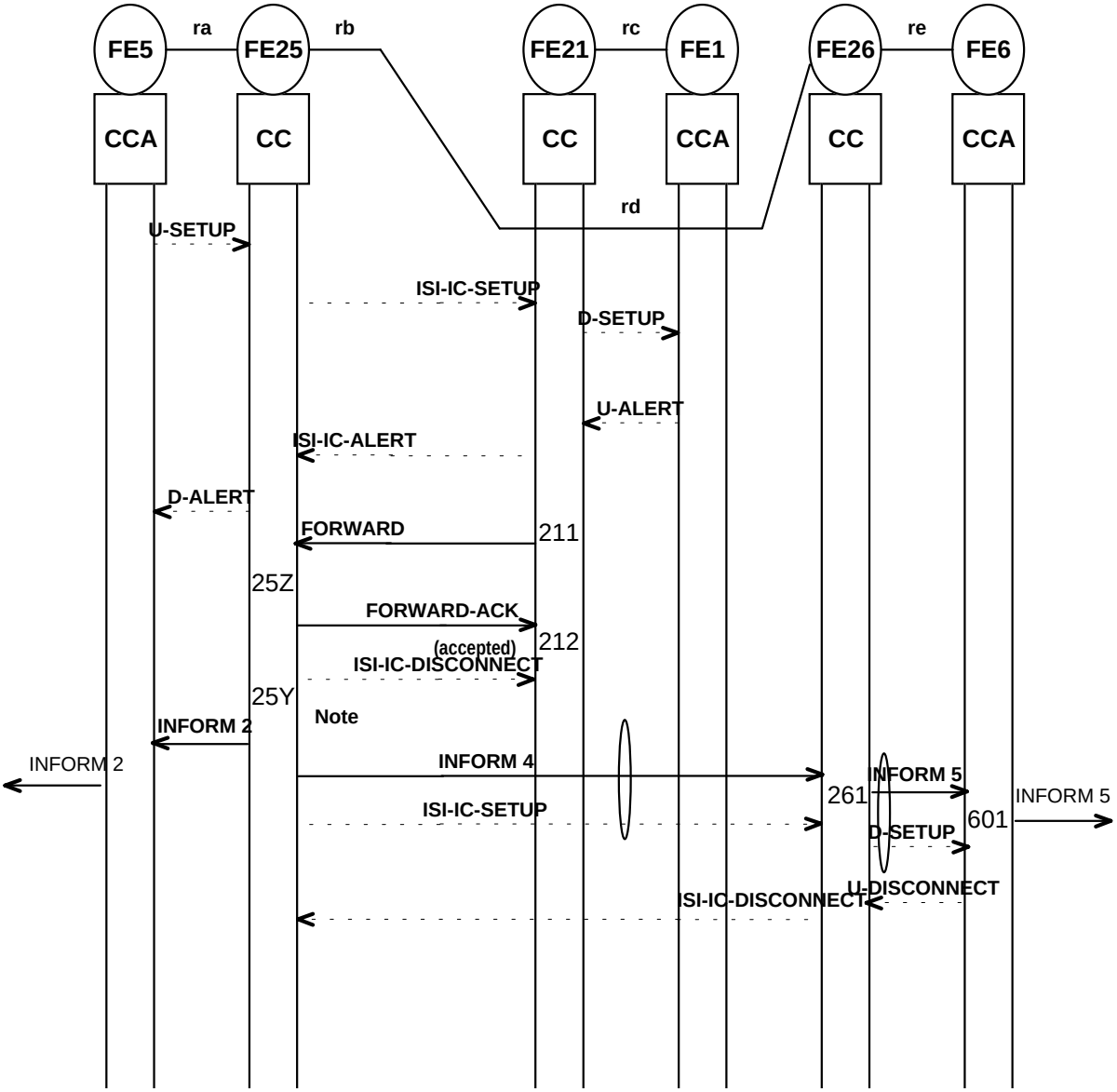
The information flow sequence for clearing by user A during CFNRy operation is shown in figure 18.



NOTE: The INFORM1 information flow is internal to FE25 in the case of re-routeing.

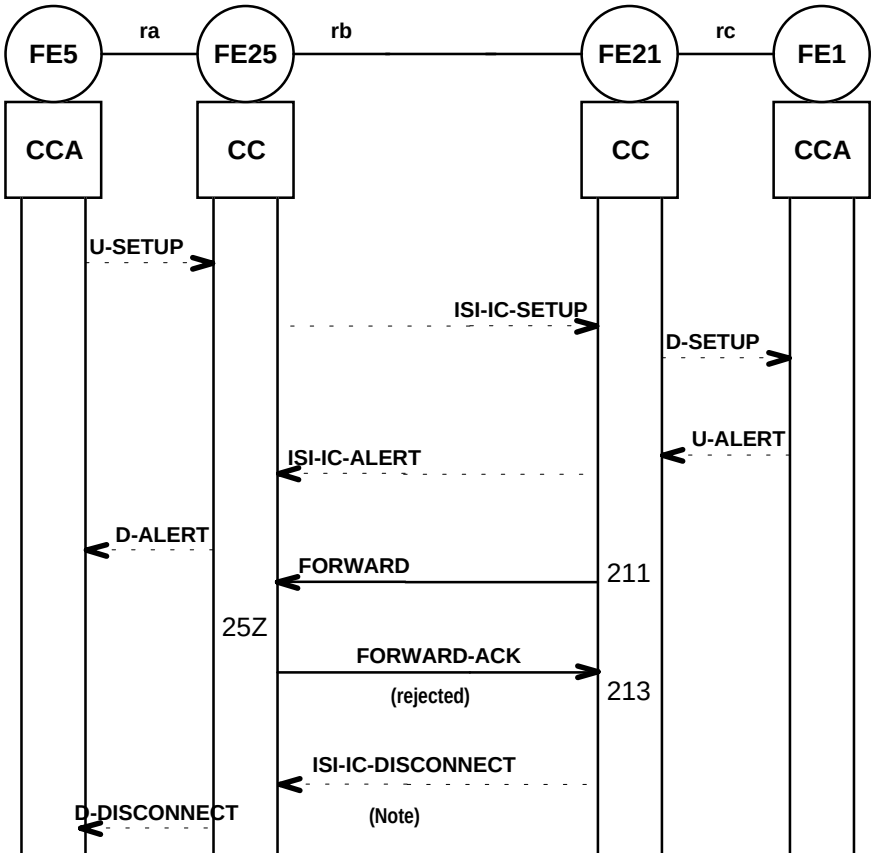
Figure 18: Information Flow Sequence for clearing by user A during CFNRy operation; case of re-routeing

The information flow sequences for unsuccessful CFNRy operation are shown in figures 19 and 20.



NOTE: The INFORM 1 information flow is internal to FE25 in the case of re-routeing.

Figure 19: Information Flow Sequences for unsuccessful CFNRy operation: CFNRy not completed, original call cleared; case of re-routeing

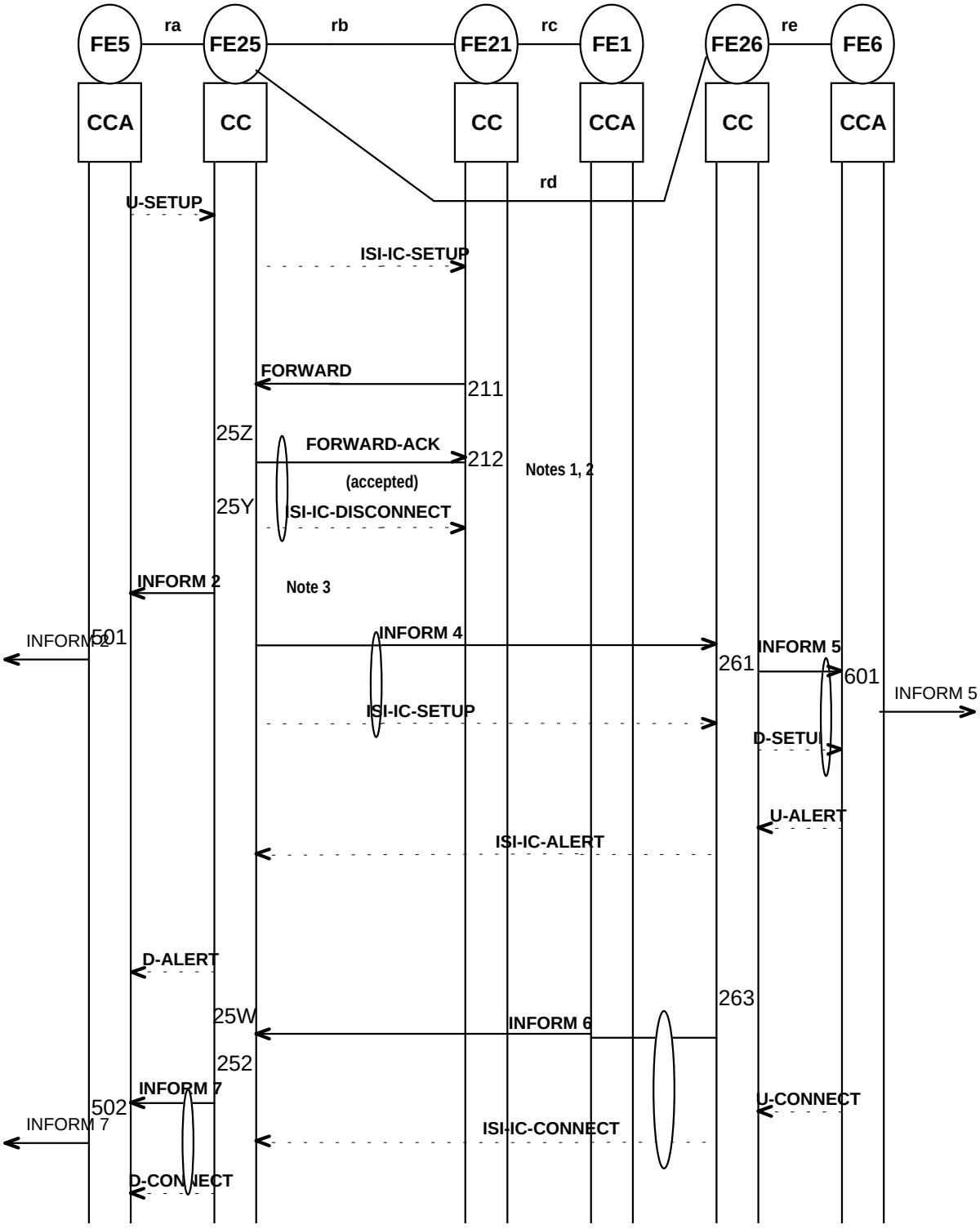


NOTE: With a new disconnect cause unsuccessful call forwarding.

Figure 20: Information Flow Sequences for unsuccessful CFNRy operation: CFNRy rejected, original call cleared; case of re-routeing

4.1.2.2.1.3 Information flow sequences for CFNRc operation

The information flow sequence for successful CFNRc operation is shown in figure 21.



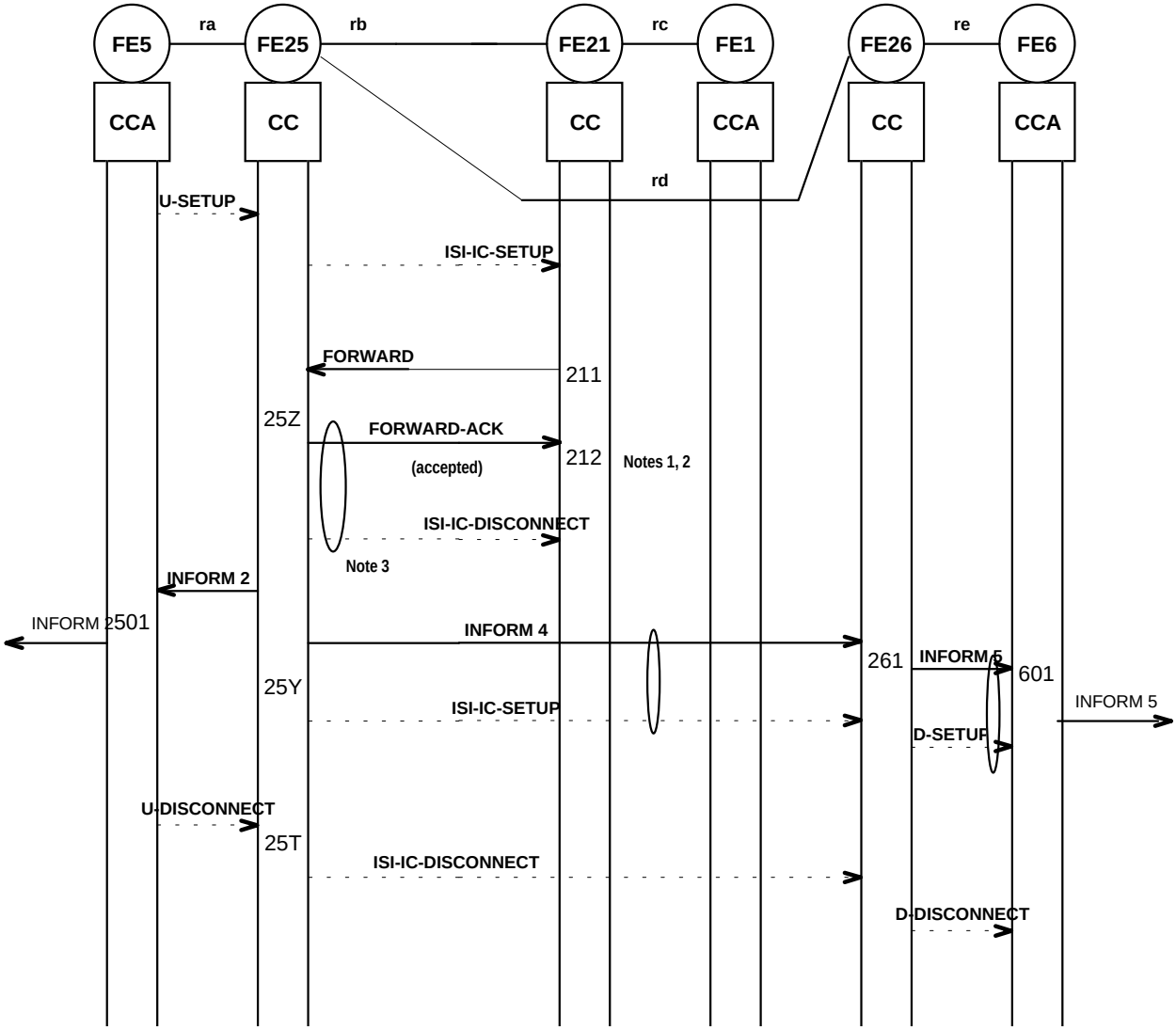
NOTE 1: There is no INFORM information flow towards FE1 since it is in a not reachable status.

NOTE 2: It is assumed that FE1 is not reachable for the whole duration of the call setup.

NOTE 3: The INFORM 1 Information flow is internal to FE25 in the case of re-routeing.

Figure 21: Information Flow Sequence for successful CFNRc operation; case of re-routeing

The information flow sequence for clearing by user A during CFNRc operation is shown in figure 22.



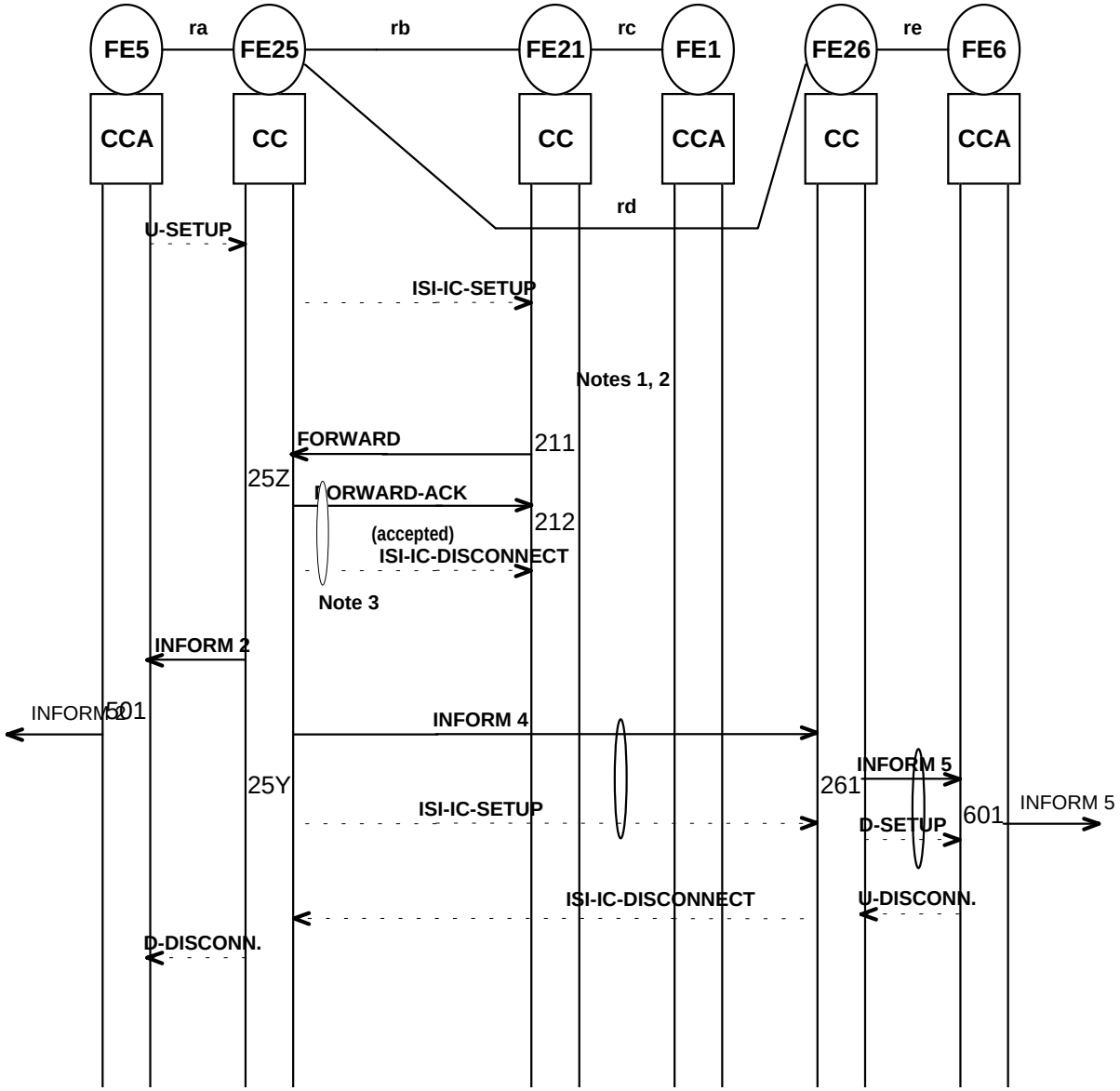
NOTE 1: There is no INFORM information flow towards FE1 since it is in a not reachable status.

NOTE 2: It is assumed that FE1 is not reachable for the whole duration of the call setup.

NOTE 3: The INFORM 1 Information Flow is internal to FE25 in the case of re-routeing.

Figure 22: Information Flow Sequence for clearing by user A during CFNRc operation; case of re-routeing

The information flow sequences for unsuccessful CFNRc operation are shown in figures 23 and 24.

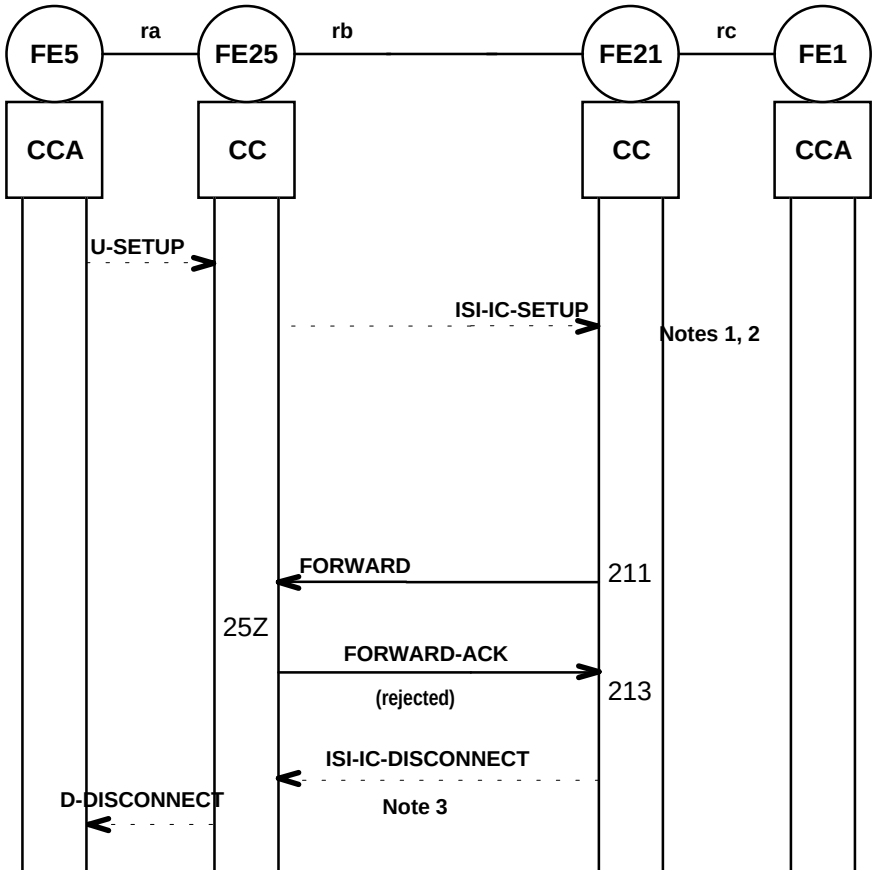


NOTE 1: User B is assumed to be not reachable during the whole call duration so that it cannot be presented WITH ANY OF THE inform Information Flow.

NOTE 2: Normal disconnection may also take place as a result of timer expiry or calling user aborting the call.

NOTE 3: The INFORM 1 Information Flow is internal to FE25 in the case of rerouteing.

Figure 23: Information Flow Sequences for unsuccessful CFNRc operation: CFNRc not completed, original call disconnected; case of re-routeing



NOTE 1: User B is assumed to be not reachable during the whole call duration so that it cannot be presented WITH ANY OF THE inform Information Flow.

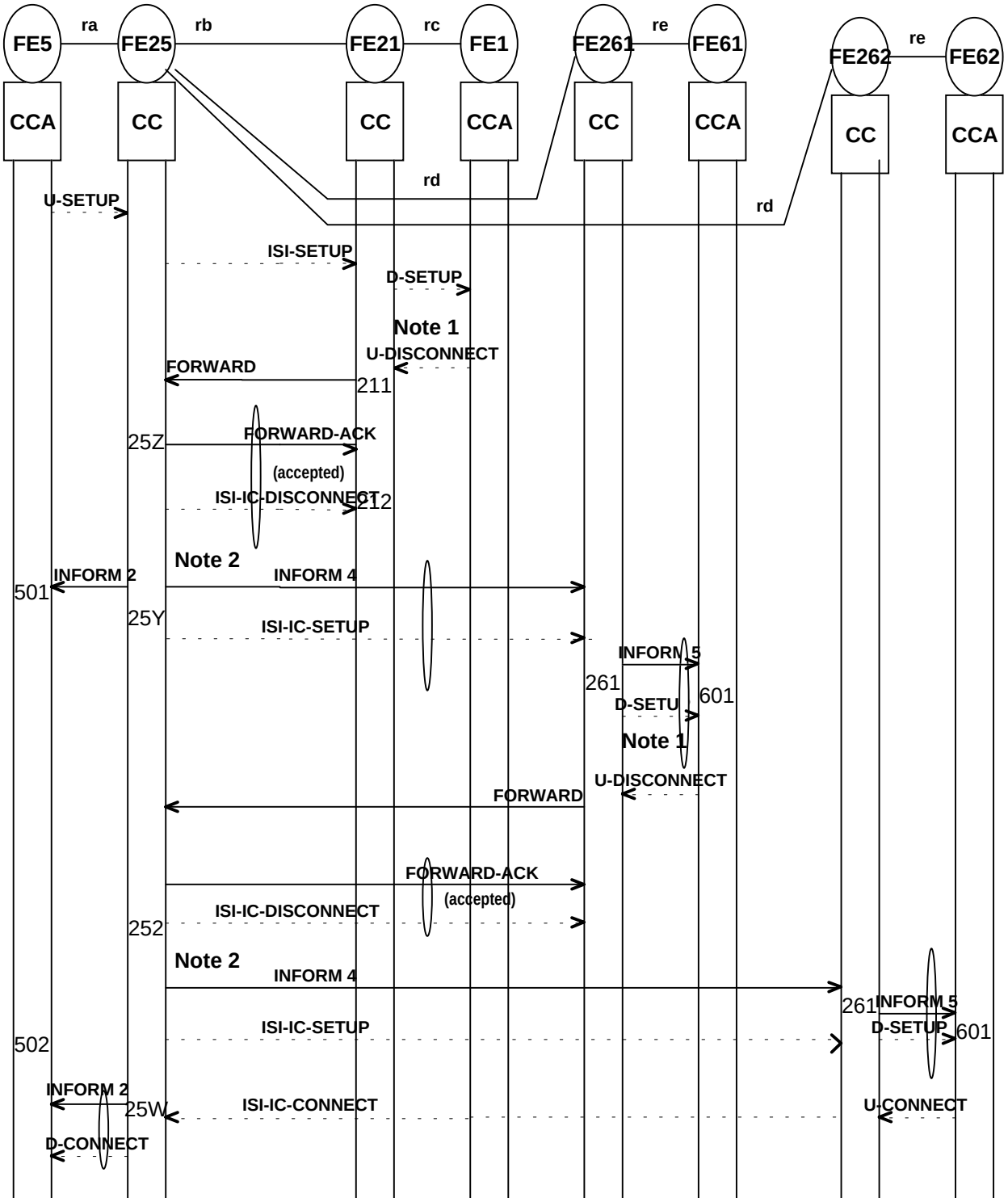
NOTE 2: Normal disconnection may also take place as a result of timer expiry or calling user aborting the call.

NOTE 3: The INFORM 1 Information Flow is internal to FE25 in the case of rerouteing.

Figure 24: Information Flow Sequences for unsuccessful CFNRc operation: CFNRc rejected, original call cleared; case of re-routeing

4.1.2.2.1.4 Information flow sequenced for two stage forwarding, individual call, case of re-routeing

In order to show the case of a double forwarding in the case of re-routeing where the first forwarded-to user is also busy, figure 25 shows the corresponding information flow information flow.



NOTE: Due to lack of drawing space, on this figure some primitives have not been shown.

Figure 25: Information Flow Sequence for double call forwarding CFB operation: User B1 busy; case of re-routeing

4.1.2.2.1.5 Normal operation of FC

Figure 26 shows the information flow sequence for normal operation of FC.

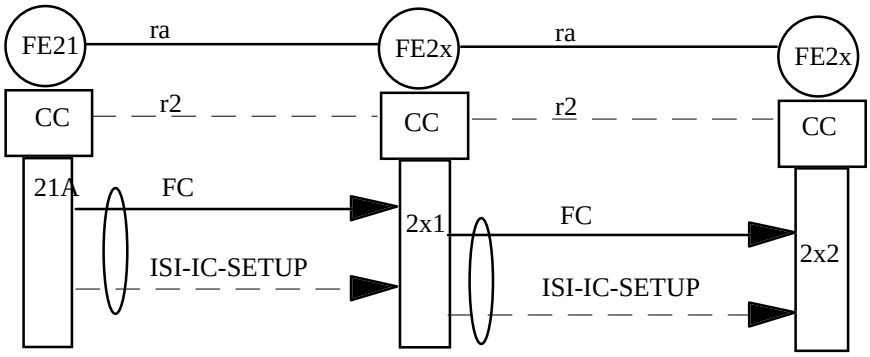


Figure 26: Information flow sequence; normal operation of FC

4.1.2.2.1.6 Forwarding counter limit exceeded

Figure 27 shows the information flow sequence for the case that the allowed limit of the forwarding counter is exceeded.

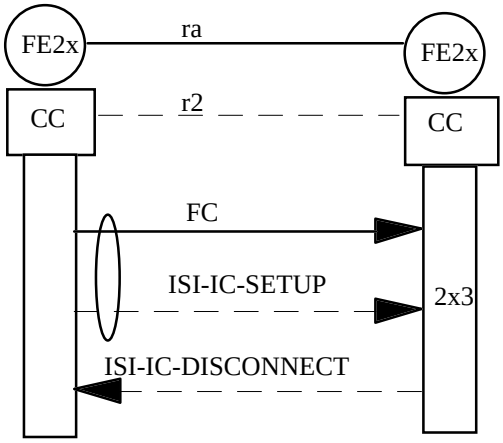
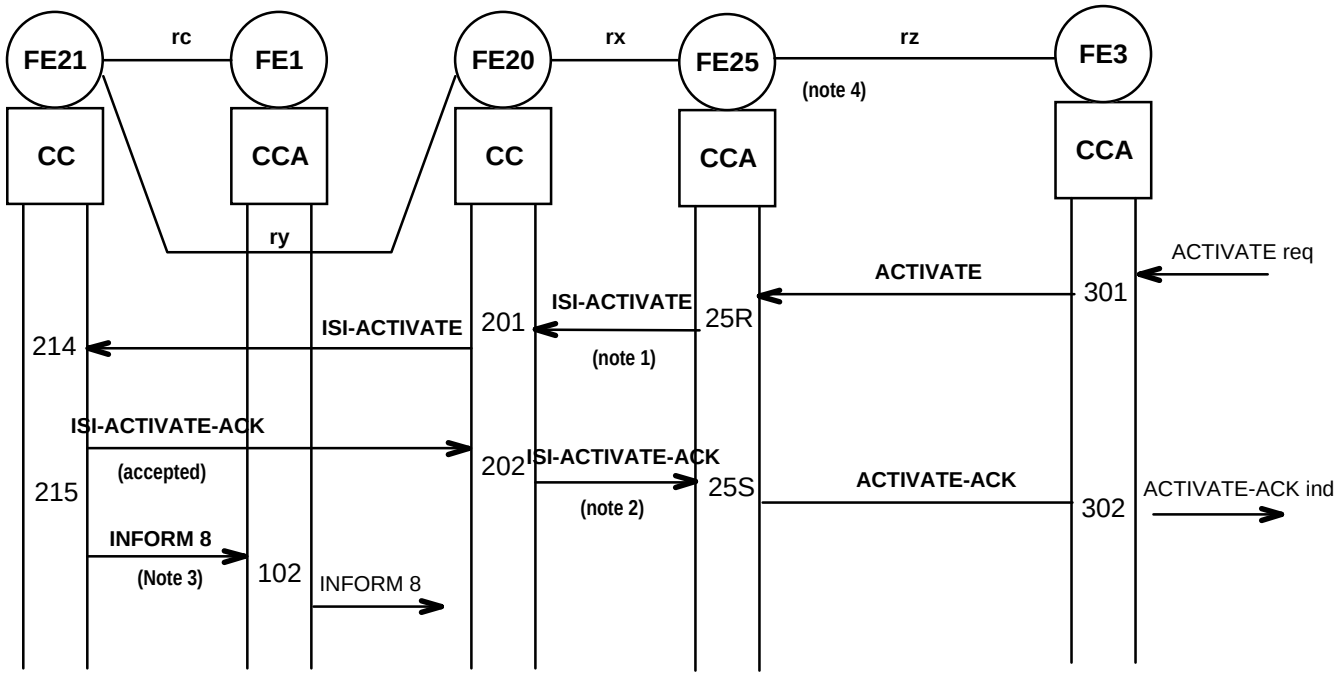


Figure 27: Information flow sequence; forwarding counter limit exceeded

4.1.2.2.1.7 Information flow sequences for SS-CF activation/deactivation

The information flow sequence for activation/deactivation of SS-CF is shown in figure 28.



NOTE 1: In the case where the visited swMI of called/served user is different from called/served user home SwMI, any change in profile in the visited SwMI will have to be authorized by the home SwMI. This flows does not exist for the deactivate process.

NOTE 2: This information flow corresponds to the authorization of the profile change within the visited SwMI. In case of rejection, the called/served user will keep its former profile; the called/served user may also have a local profile within FE25 which is different from the home SwMI profile. This flows does not exist in the deactivate process.

NOTE 3: In the case of deactivate flow, replace "ACTIVATE" by "DEACTIVATE" and INFORM 8 by INFORM 9 both for the information flow and for the primitive.

NOTE 4: FE25 is any FE different from home SwMI FE. FE3 is collocated with FE1.

Figure 28: Information Flow Sequence for activation/deactivation

4.1.2.2.1.8 Information flow sequence for enabling/disabling of SS-CF authorized user activation/deactivation

The information flow sequences for enabling/disabling of authorized user SS-CF activation/deactivation by the served user is shown in figure 29.

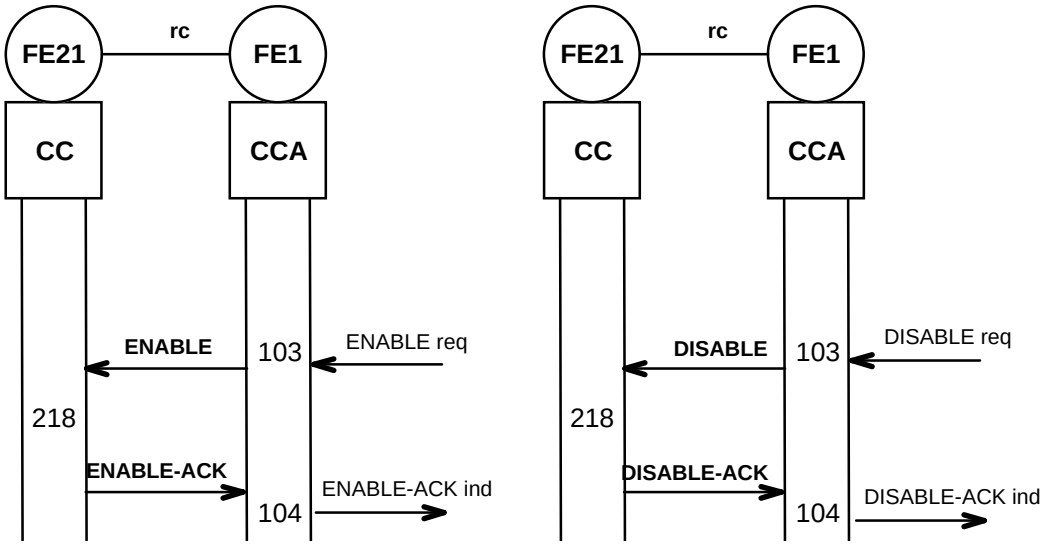


Figure 29: Information Flow Sequence for enabling/disabling of authorized user activation/deactivation

4.1.2.2.1.9 Information flow sequence for SS-CF interrogation

The information flow sequences for interrogation of SS-CF is shown in figure 30.

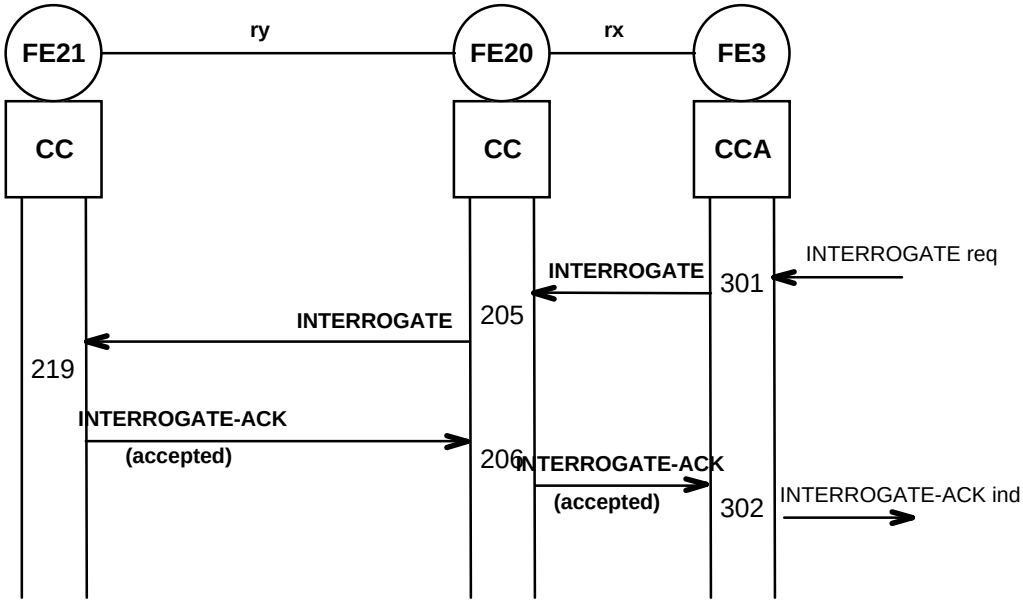


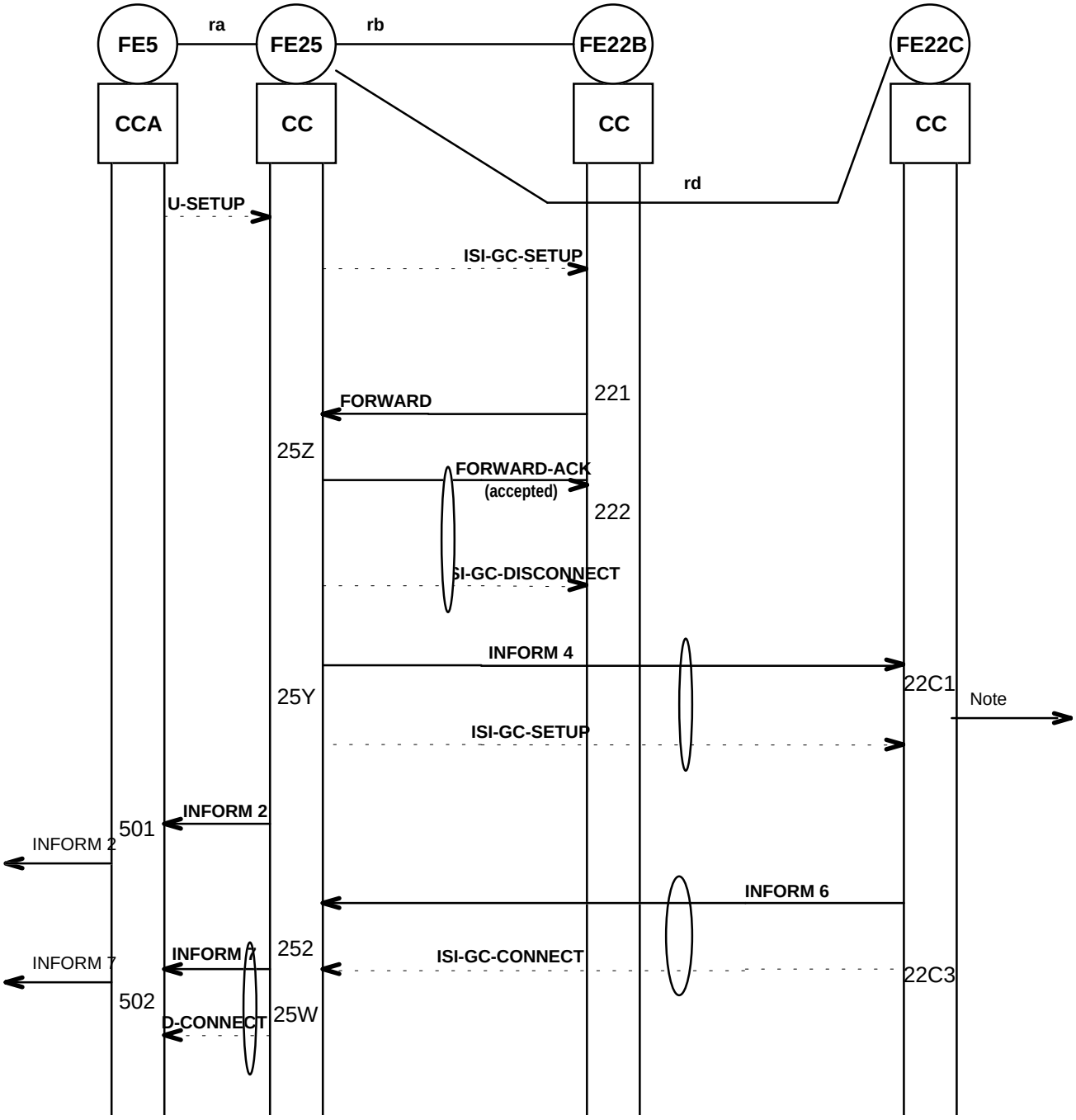
Figure 30: Information Flow Sequences for interrogation

4.1.2.2.2 Case of group call

In the case of group calls, only SS-CFU and SS-CFB are relevant; for group calls, forward switching does not apply; for group calls, only NDUB (Network Determined User (Group) Busy applies; in the information flows concerning group calls that follow, the cases of group call forwarding to an ITSI and forwarding of an individual call to a GTSI are not shown.

4.1.2.2.2.1 Information flow sequences for CFU/CFB operation

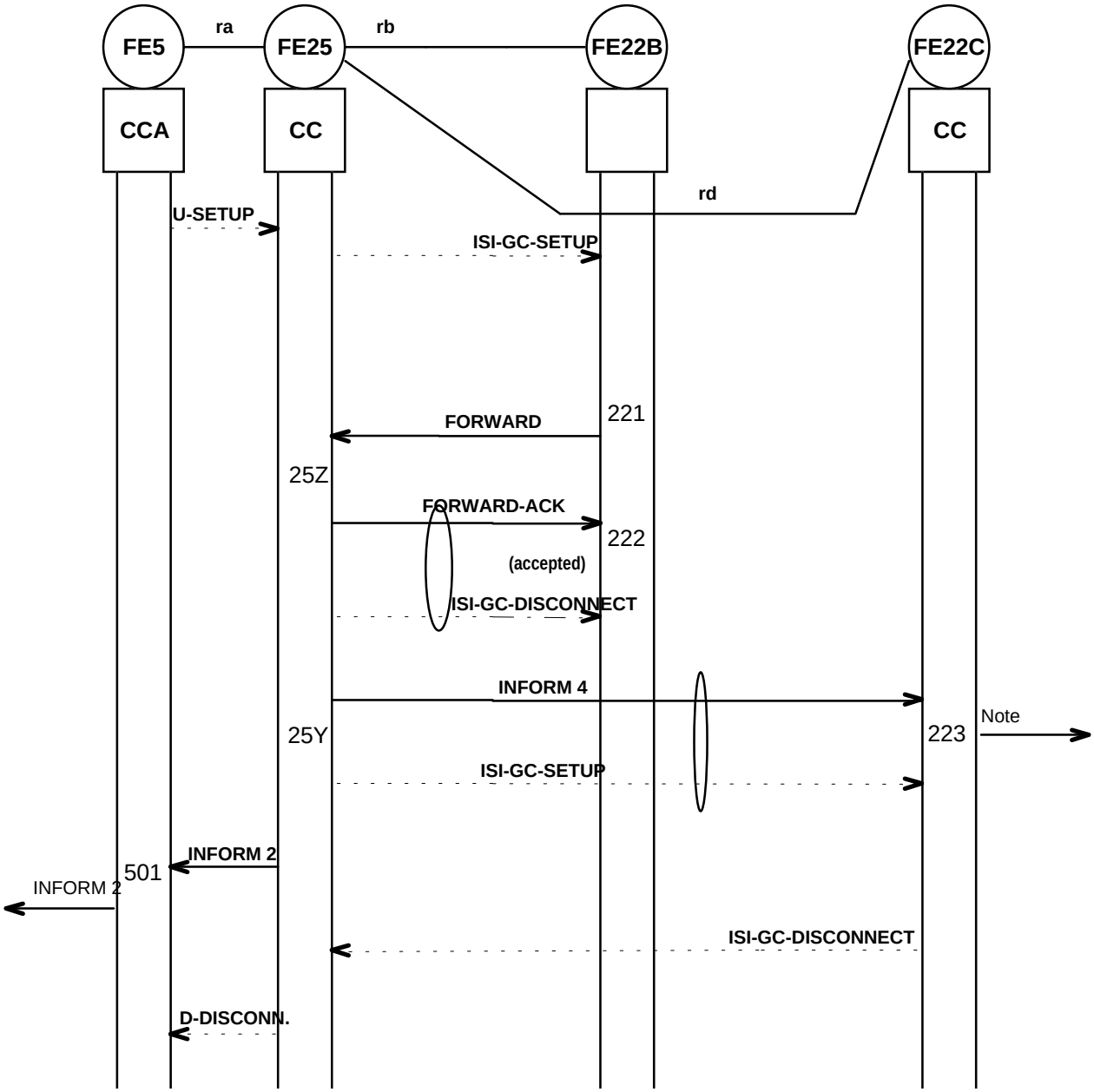
The information flow sequence for successful CFU/CFB operation on group call is shown in figure 31. The case of SS-CFB corresponds to NDUB.



NOTE: The destination of the INFORM 5 information flow in the case of group call is implementation dependent; it could be dropped, presented to all members of the group or only presented to the group owner.

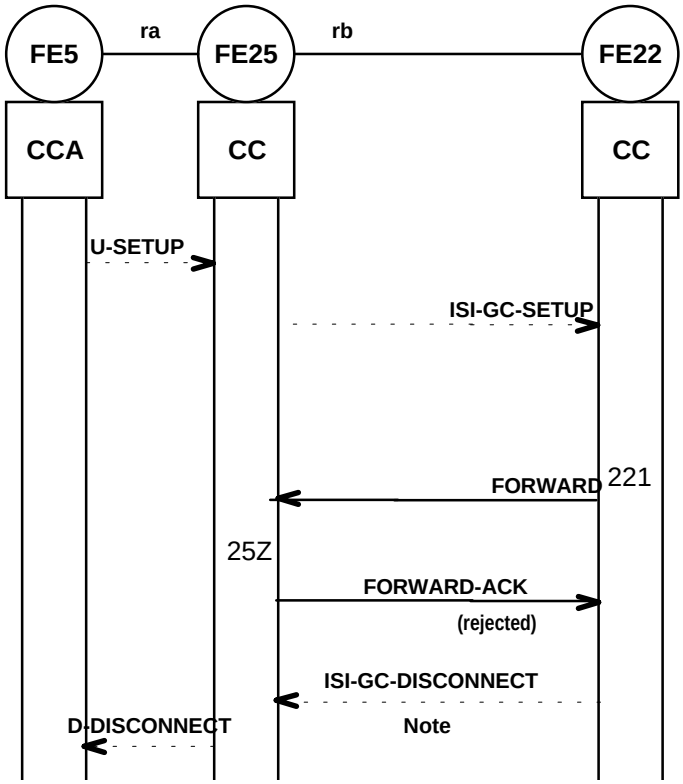
Figure 31: Information Flow Sequence for successful CFU/CFB operation; case of group call; re-routeing

The information flow sequences for unsuccessful CFU/CFB operation in the case of a group call are shown in figures 32 and 33.



NOTE: The destination of the INFORM 5 information flow in the case of group call is implementation dependent; it could be dropped, presented to all members of the group or only presented to the group owner.

Figure 32: Information Flow Sequence for unsuccessful CFU/CFB operation: case of group call; failure of forwarded call.



NOTE: With a disconnect cause due to unsuccessful call forwarding.

Figure 33: Information Flow Sequences for unsuccessful CFU/CFB operation: case of group call; rejection of call forwarding; case of re-routeing only

4.1.2.2.2.2 Information flow sequences for SS-CF activation/deactivation

The information flow sequences for activation of SS-CF are the same as in the case of individual call, re-routeing; subclause 4.1.2.2.1.5. shall apply.

4.1.2.2.2.3 Information flow sequence for enabling/disabling of authorized user SS-CF activation/deactivation

The information flow sequences for enabling/disabling of authorized user SS-CF activation/deactivation is the same as in the case of individual call, re-routeing, see subclause 4.1.2.2.1.6.

4.1.2.2.2.4 Information flow sequence for SS-CF interrogation

The information flow sequences for interrogation of SS-CF are the same as in the case of individual call, re-routeing see subclause 4.1.2.2.1.7.

4.1.3 Functional entity actions

The following FEAs shall occur at the points indicated in the figures of subclause 4.1.2.2.

4.1.3.1 Actions of FE1

102 Deliver notifications on activation and deactivation to the user as received from FE21.

103 Send enable/disable requests to FE21 as received from the user.

104 Deliver enable/disable responses to the user as received from FE21.

NOTE: Action numbers 105 and 106 are skipped (correspond in ECMA-173 [1] to CD actions).

4.1.3.2 Actions of FE3

301 Send activation/deactivation/interrogation requests to FE20 as received from the user.

302 Deliver activation/deactivation/interrogation responses to the user as received from FE20.

4.1.3.3 Actions of FE5

501 Deliver call forwarding notifications to the user as received from FE25 in INFORM 2.

502 Deliver number notifications to the user as received in INFORM 7 from FE25.

4.1.3.4 Actions of FE6

601 Deliver notifications to the forwarded-to user as received from FE26.

4.1.3.5 Actions of FE20

201 Receive ACTIVATE/DEACTIVATE from FE3. Perform address checking and either relay the ACTIVATE/DEACTIVATE to FE21 or send a negative ACTIVATE ACK/DEACTIVATE ACK to FE3.

202 Receive ACTIVATE ACK/DEACTIVATE ACK from FE21 and relay it to FE3.

NOTE: Actions 203 and 204 are duplicate of 201 202 in the case of DEACTIVATE.

205 Receive INTERROGATE from FE3. Perform address checking and either relay the INTERROGATE to FE21 or send a negative INTERROGATE ACK to FE3.

206 Receive INTERROGATE ACK from FE21 and relay it to FE3.

4.1.3.6 Actions of FE21

211 Immediate in the case of CFU/CFNRc, on detection of busy in the case of CFB or after a specified time interval in case of CFNRy:

- recognize call forwarding activated and invoked from Basic Service;
- increment the forwarding counter;
- if the incremented forwarding counter has exceeded the upper limit, reject the forwarding request and for CFU/CFB and CFNRy/CFNRc release the call;
- if the incremented forwarding counter is not above the upper limit, then send a FORWARD to FE25.

212 Receive the positive FORWARD ACK from FE25.

213 Receive the negative FORWARD ACK from FE25. For CFU/CFB/CFNRy: stimulate release of the call to the calling user.

214 Validate received ACTIVATE/DEACTIVATE.

215 Further validate received ACTIVATE/DEACTIVATE and respond to FE20 with ACTIVATE ACK/DEACTIVATE ACK. Inform FE1 of a successful activation/deactivation (INFORM 8 for ACTIVATE, INFORM9 FOR DEACTIVATE).

NOTE: ACTIVATE and DEACTIVATE have been merged in a single information flow, thus the skip in action numbers 216 and 217 compared to ECMA-173 [1].

218 Validate received ENABLE/DISABLE and respond to FE1 with ENABLE ACK/DISABLE ACK.

219 Validate received INTERROGATE and respond to FE20 with INTERROGATE ACK.

21A Recognize the invocation of FC, set the forwarding counter to the initial value and send FC to FE2x.

4.1.3.7 Actions of FE22

221 Immediate in the case of CFU, on detection of busy in the case of CFB:

- recognize call forwarding activated and invoked from Basic Service;
- increment the forwarding counter;
- if the incremented forwarding counter has exceeded the upper limit, reject the forwarding request and for CFU/CFB release the call;
- if the incremented forwarding counter is not above the upper limit, then send a FORWARD to FE25.

222 Receive the positive FORWARD ACK from FE25.

223 Determine if presentation of the number information received from FE25 in INFORM 4 is allowed and send INFORM 5 to the appropriate FE. Store the last forwarding number and original called number and associated presentation restriction indicators for further multiple call forwarding.

224 Send the presentation indicator of the diverted-to user's number either on receipt of U-ALERT (alerting) if possible or at latest on answer of the basic call to FE25 in INFORM 6.

4.1.3.8 Actions at FE22C

22C1 Determine if presentation of the number information received from FE25 in INFORM 4 is allowed and send INFORM 5 to group members. Store the last forwarding number and original called number and associated presentation restriction indicators for further multiple call forwarding.

22C3 Send the presentation indicator of the diverted-to user's number on answer of the basic call to FE25 in INFORM 6.

4.1.3.9 Actions of FE25

252 Receive INFORM 6 from FE25, get the stored notification subscription options, determine if presentation of information is allowed and send the appropriate number information in INFORM 7 to FE5 if allowed.

25Z Receive FORWARD, check whether the request is allowed and valid and respond to FE21 with FORWARD ACK accordingly.

25Y Stimulate the basic call establishment to FE26 if the forwarding request is valid. Stimulate the release procedure at leg rb (original call) in case of CFU, CFB or CFNRy. Send INFORM 4 to FE26.

25W Relay the presentation indicator received in INFORM 6 from FE26 to FE5.

25V In case of CFNRy, stimulate the release procedure at the forwarded-to leg (rd), when user B answers before alerting of user C.

25U In case of SS-CF invocation by served user outside its home SwMI, send REPORT-INVOCATION to served user home SwMI FE21.

25T For CFNRy, stimulate release of the leg rd if the calling user releases the call.

25S In case of SS-CF activation (change of profile) by served user outside home SwMI, FE25 obtains authorization from home SwMI to activate (change profile) of SS-CF for served user.

25R In case of SS-CF activation (change of profile) by served user outside home SwMI, FE25 requests authorization from home SwMI to activate (change of profile) of SS-CF by served user. 4.1.3.9

4.1.3.10 Actions of FE26

261 Determine if presentation of the number information received from FE25 in INFORM 4 is allowed and send INFORM 5 to FE6. Store the last forwarding number and original called number and associated presentation restriction indicators for further multiple call forwarding.

263 Send the presentation indicator of the diverted-to user's number either on receipt of U-ALERT (alerting) if possible or at latest on answer of the basic call to FE25 in INFORM 6.

4.1.3.11 Actions of FE2x

2x1 Acting as an intermediate FE2x, on receiving FC with a forwarding counter value below the limit, increment the value and send FC to the next FE2x.

2x2 Acting as the final FE2x, on receiving FC, terminate FC.

2x3 Acting as an intermediate FE2x, on receiving FC with a forwarding counter value equal to or higher than the allowed limit, reject the call set-up request.

4.1.4 Functional entity behavior

The figures in this sub clause are intended to illustrate typical FE behavior in terms of information flows sent and received.

The behavior of each FE is shown using the Specification and Description Language (SDL) defined in ITU-T Recommendation Z.100 [3].

4.1.4.1 Behavior of FE5

Figure 34 contains the SDL diagram for the functional entity FE5.

Input signals from the right represent information flows from FE25.

Output signals to the left represent primitives to the user.

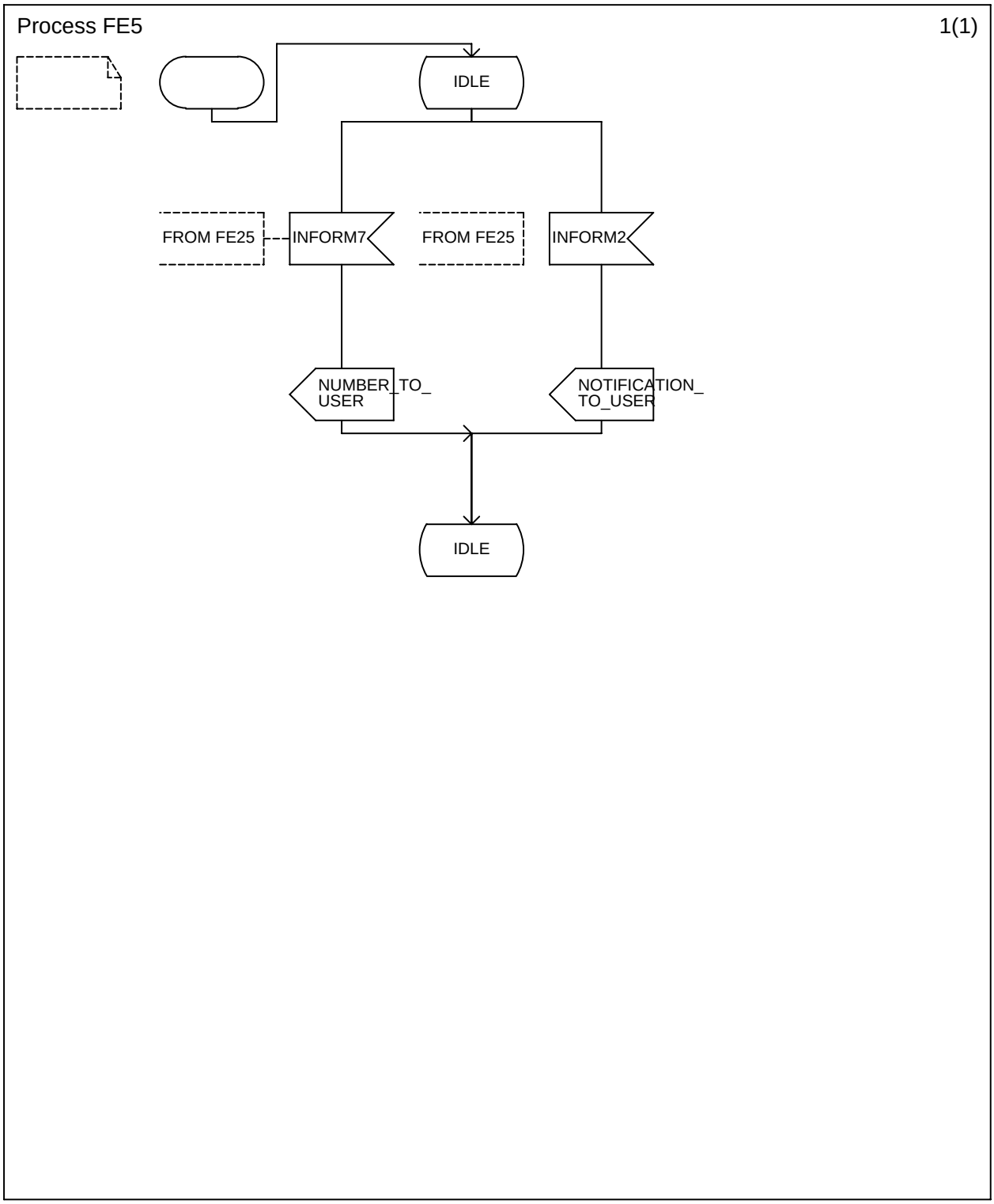


Figure 34: SDL for Functional Entity FE5

4.1.4.2 Behavior of FE25

Figure 35 contains the SDL diagram for the functional entity FE25.

Input signals from the left represent primitives from local CC.

Input signals from the right represent information flows from FE5.

Output signals to the left represent information flows to FE5.

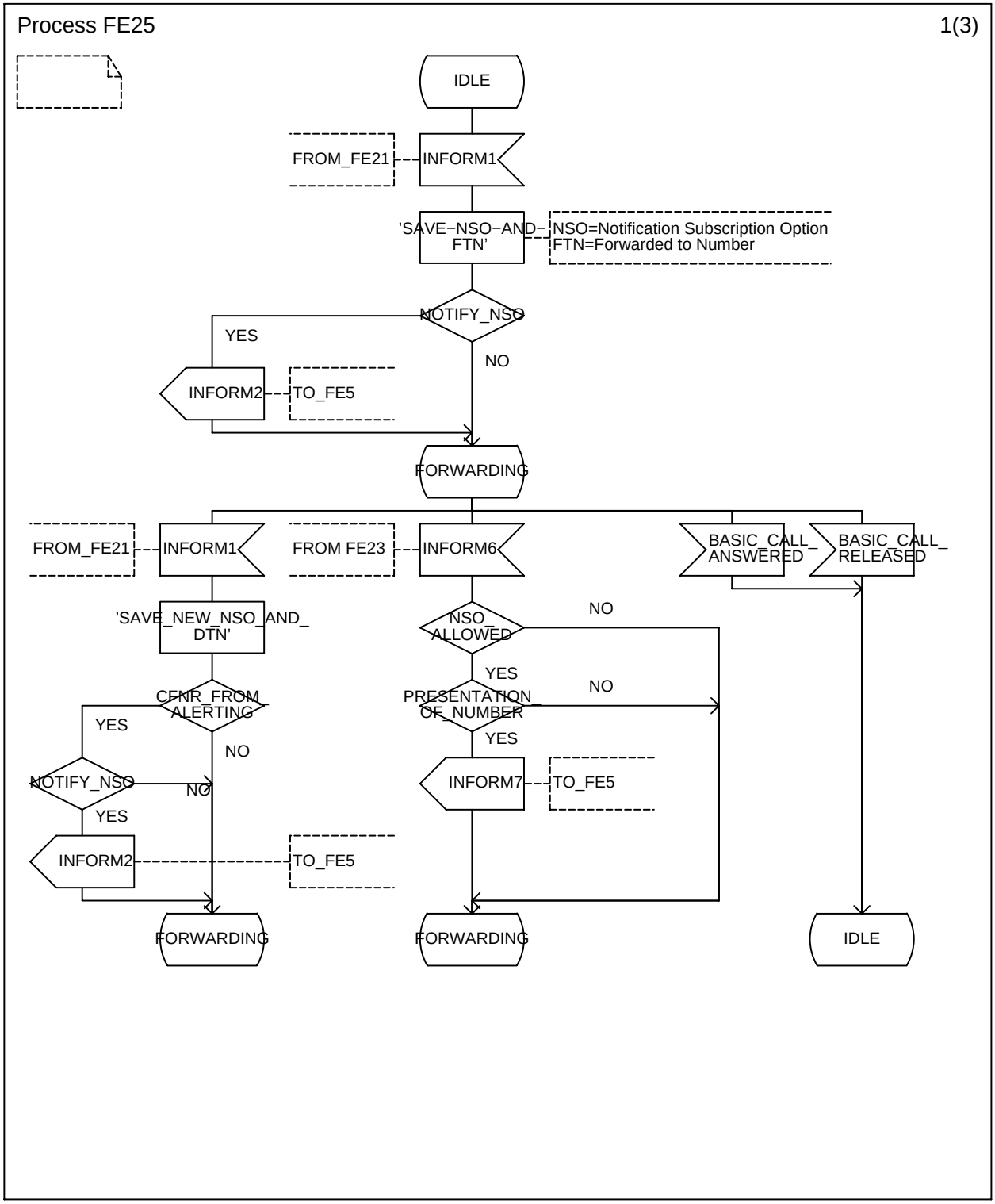


Figure 35: SDL for Functional Entity FE25 (Part 1)

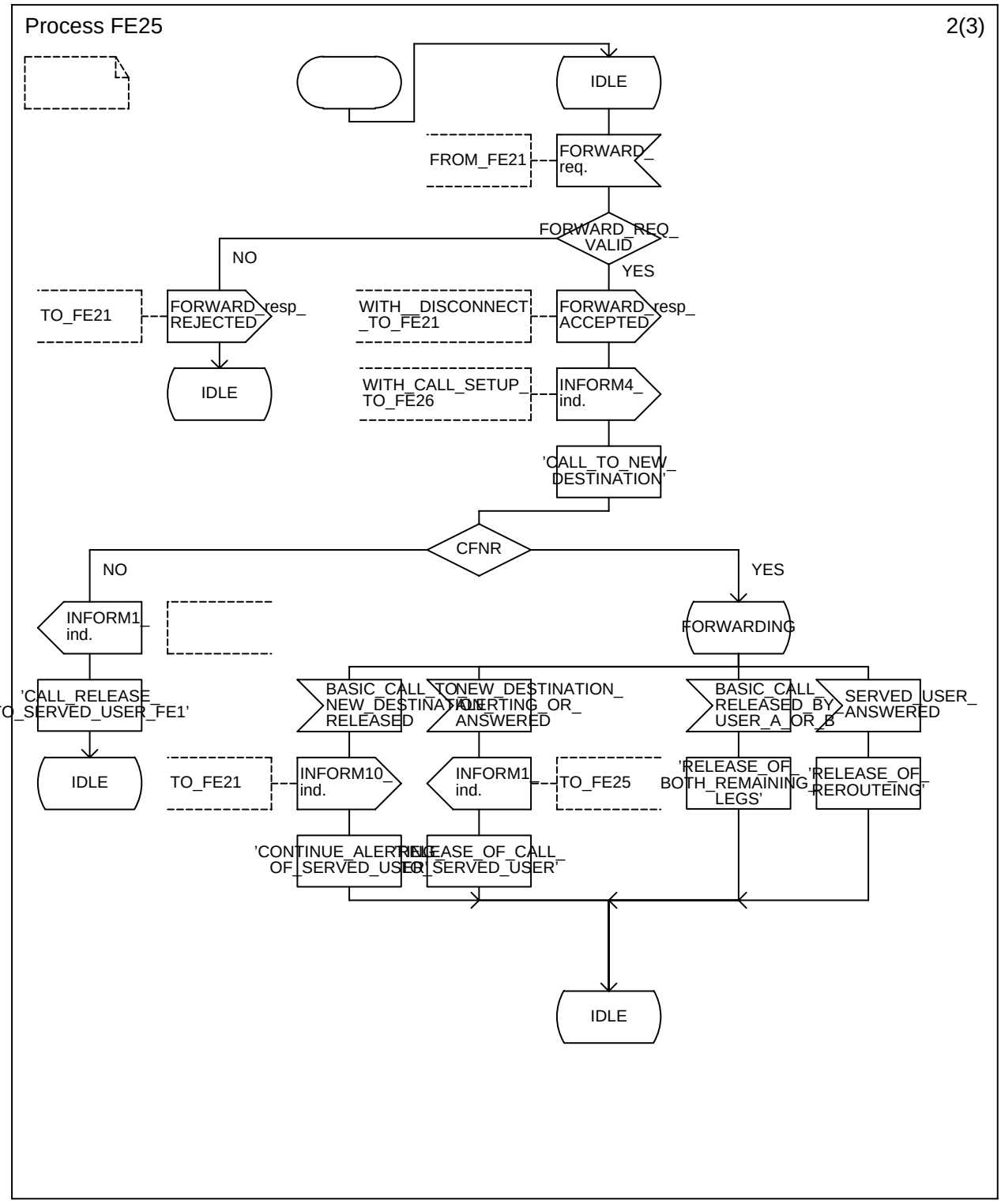


Figure 36: SDL for Functional Entity FE25 (Part 2)

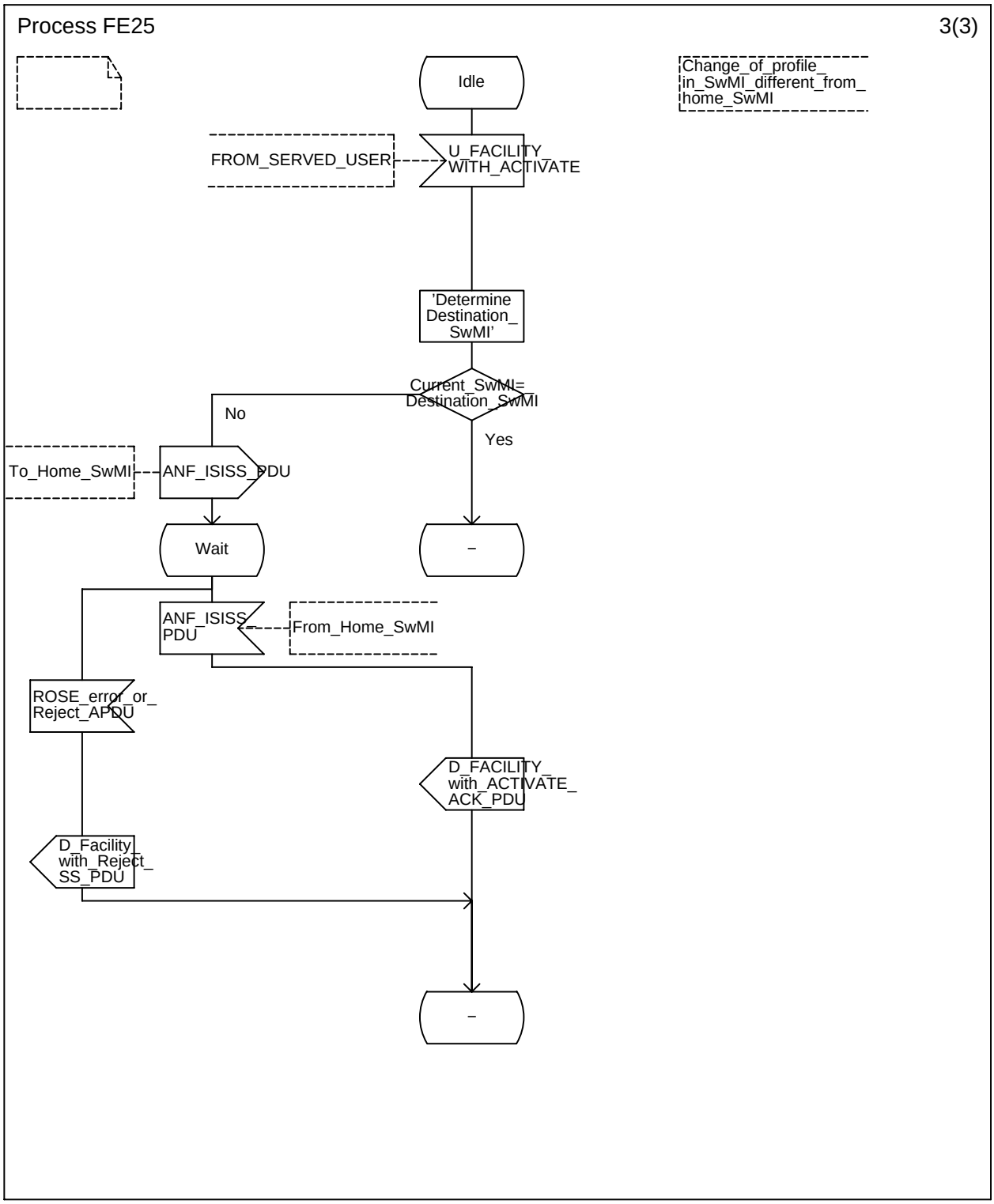


Figure 37: SDL for Functional Entity FE25 (Part 3)

4.1.4.3 Behavior of FE23

Figure 38 contains the SDL diagram for the functional entity FE23; FE23 is collocated with FE21 in the case of re routeing.

Input signals from the left represent primitives from local CC.

Input signals from the right represent information flows from other functional entities.

Output signals to the right and to the left represent information flows to other function al entities.

The relationship to the basic call process is also indicated in task symbols or in the annotations.

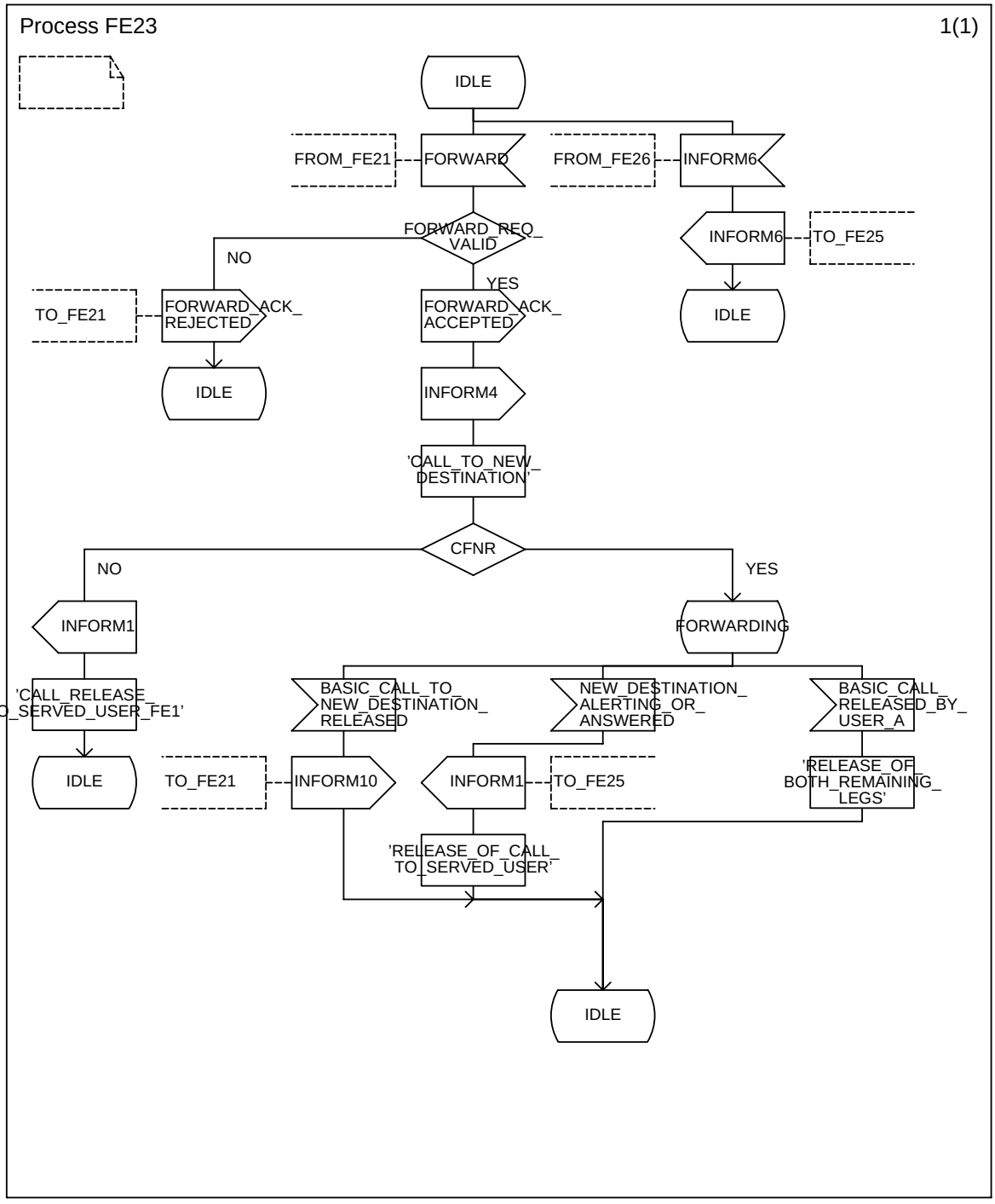


Figure 38: SDL for Functional Entity FE23

4.1.4.4 Behavior of FE21

Figures 39, 40, 41 and 42 contain the SDL diagram for the functional entity FE21.

Input signals from the left represent information flows from other functional entities or primitives from local CC.

Input signals from the right represent information flows from other functional entities or internal stimuli.

Output signals to the right and to the left represent information flows to other functional entities.

The relationship to the basic call process is also indicated in task symbols or in the annotations.

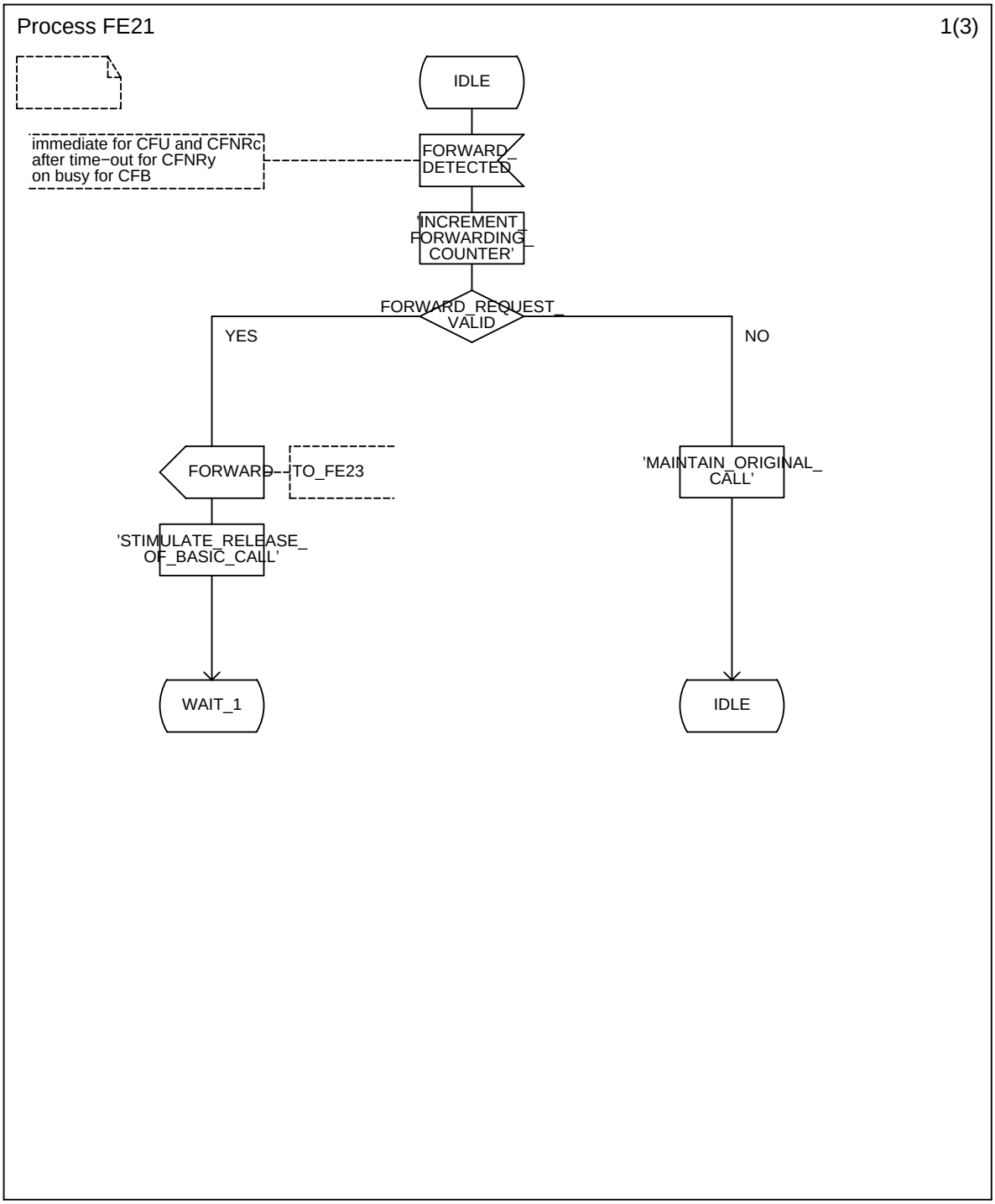


Figure 39: SDL for Functional Entity FE21 (part 1)

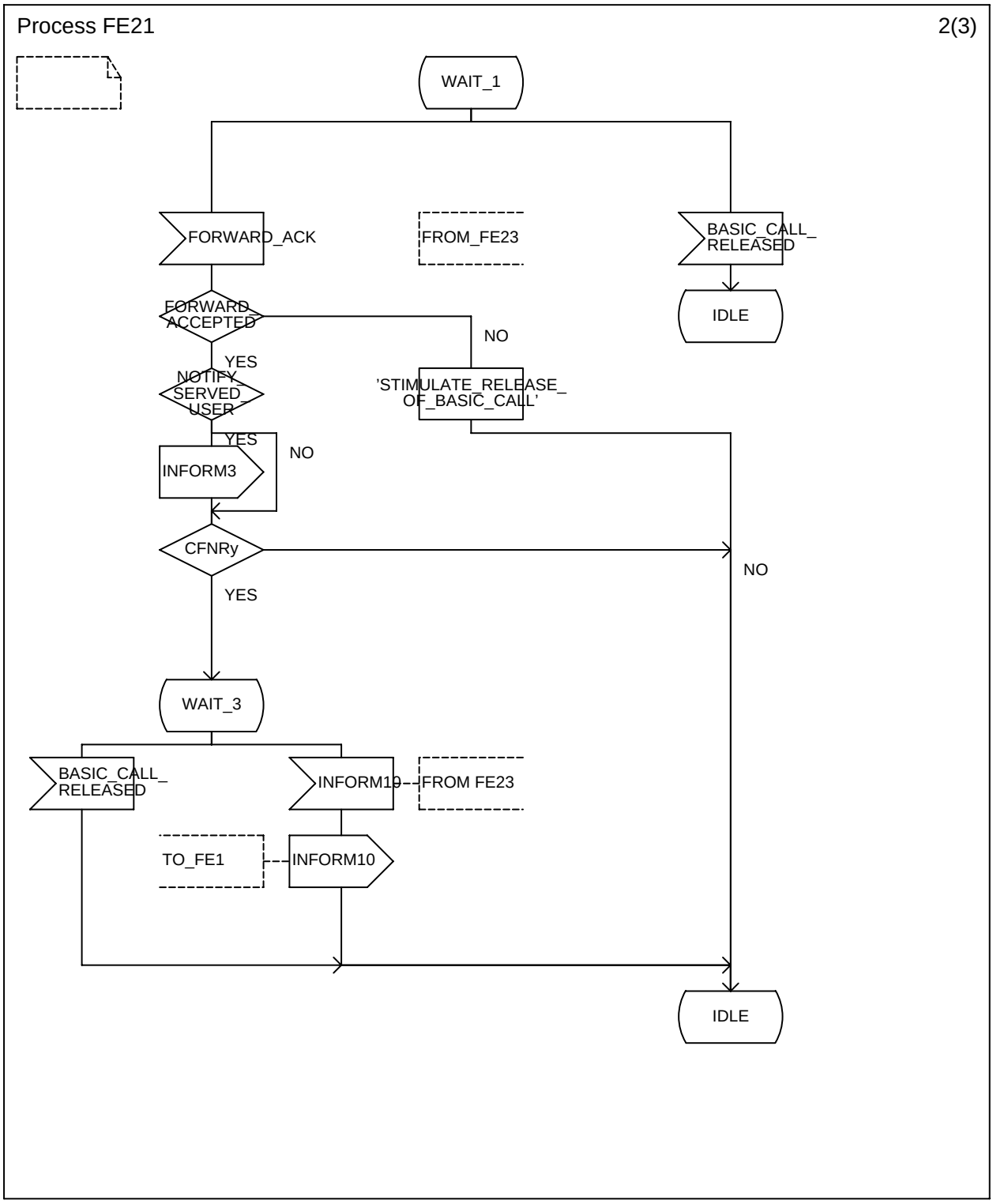


Figure 40: SDL for Functional Entity FE21 (part 2)

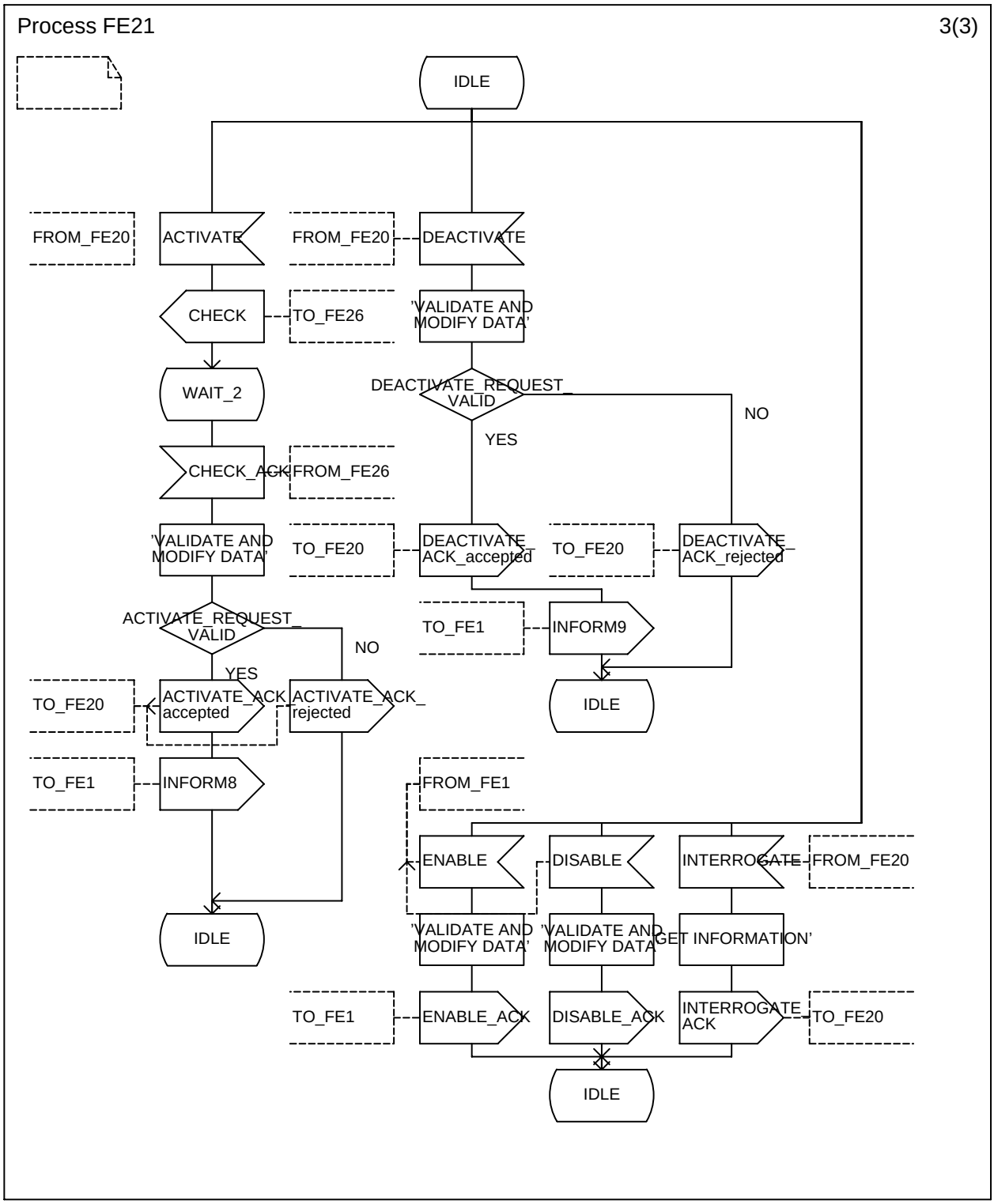


Figure 41: SDL for Functional Entity FE21 (part 3)

Figure 42 shows the normal behaviour of FE21. Input symbols from the left represent internal stimuli. Output symbols to the right represent information flows to FE2x.

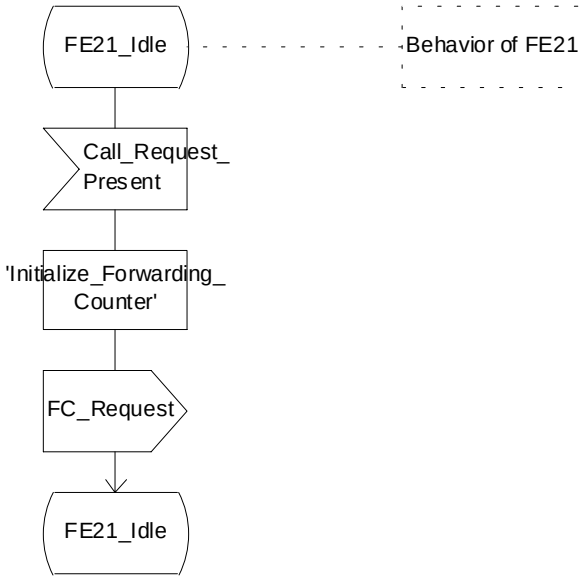


Figure 42: FC, SDL for functional entity FE21

4.1.4.5 Behavior of FE1

Figure 43 contains the SDL diagram for the functional entity FE1.

Input signals from the left represent information flows from FE21.

Input signals from the right represent primitives from the user.

Output signals to the left represent information flows to FE21.

Output signals to the right represent primitives to the user.

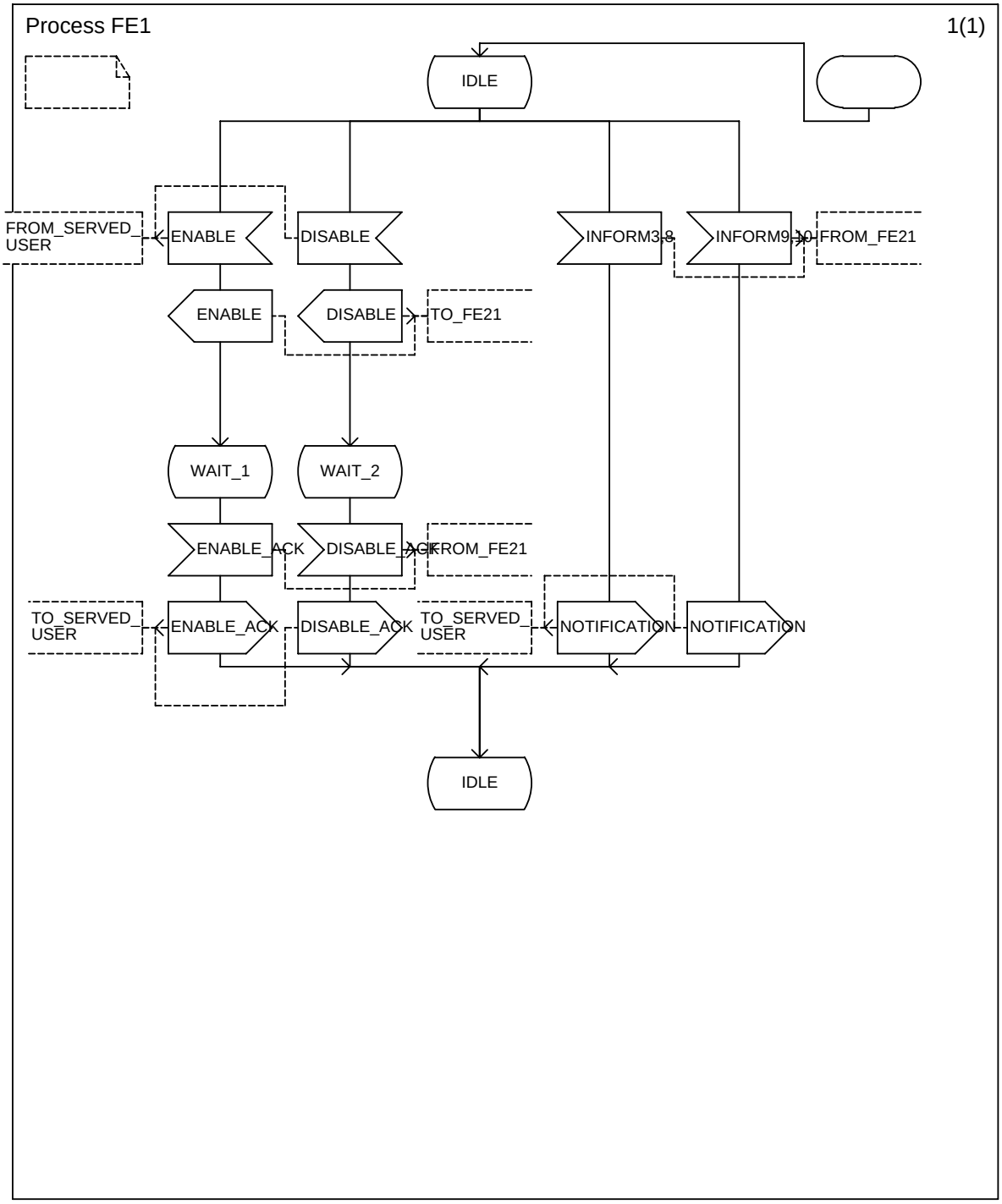


Figure 43: SDL for Functional Entity FE1

4.1.4.6 Behavior of FE26

Figure 44 contains the SDL diagram for the functional entity FE26.

Input signals from the left represent information flows from FE25 or FE21.

Input signals from the right represent primitives from local CC.

Output signals to the right and to the left represent information flows to other functional entities.

The relationship to the basic call process is also indicated in task symbols or in the annotations.

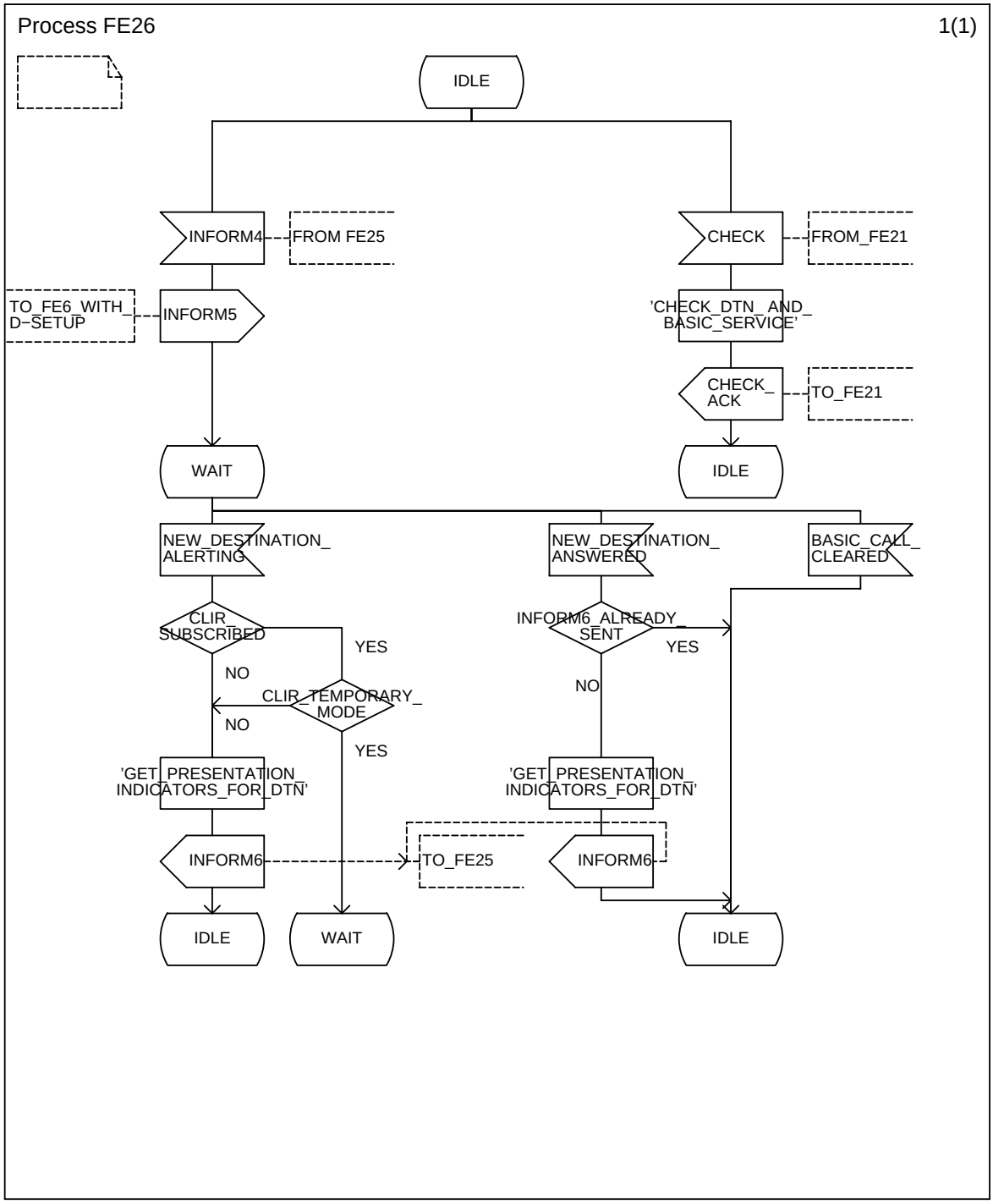


Figure 44: SDL for Functional Entity FE26

4.1.4.7 Behavior of FE6

Figure 45 contains the SDL diagram for the functional entity FE6.

Input signals from the left represent information flows from FE26.

Output signals to the right represent primitives to the user.

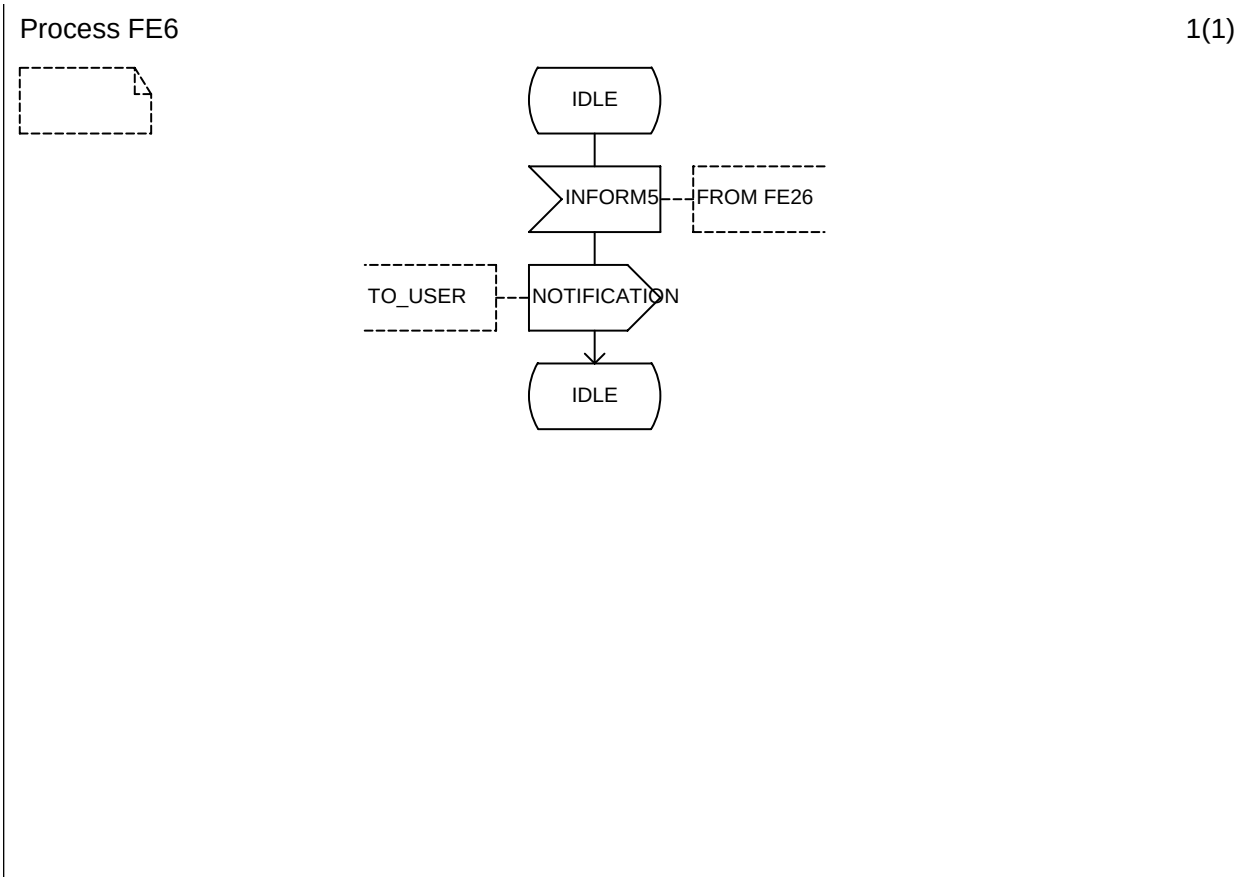


Figure 45: SDL for Functional Entity FE6

4.1.4.8 Behaviour of FE2x

Figure 46 shows the normal behaviour of FE2x. Input symbols from the left represent information flows from other FEs. Output symbols to the right represent information flows to another FE2x. Output symbols to the left represent internal stimuli.

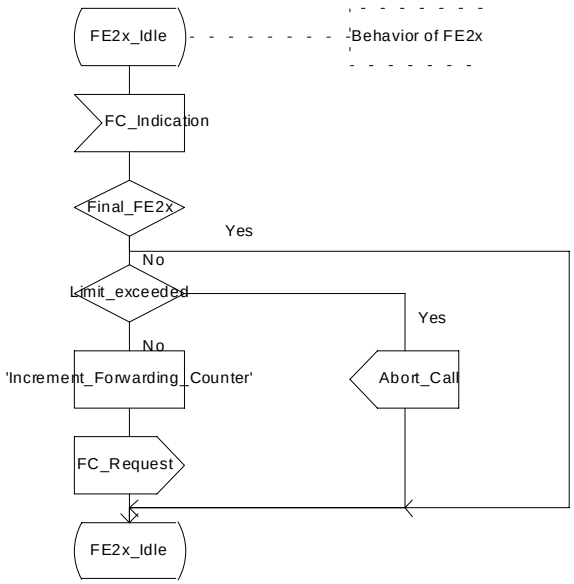


Figure 46: FC, SDL for functional entity FE2x

4.1.4.9 Behavior of FE20

Figure 47 shows the behavior of the supplementary service control entity specific to the SwMI where the authorized user is registered.

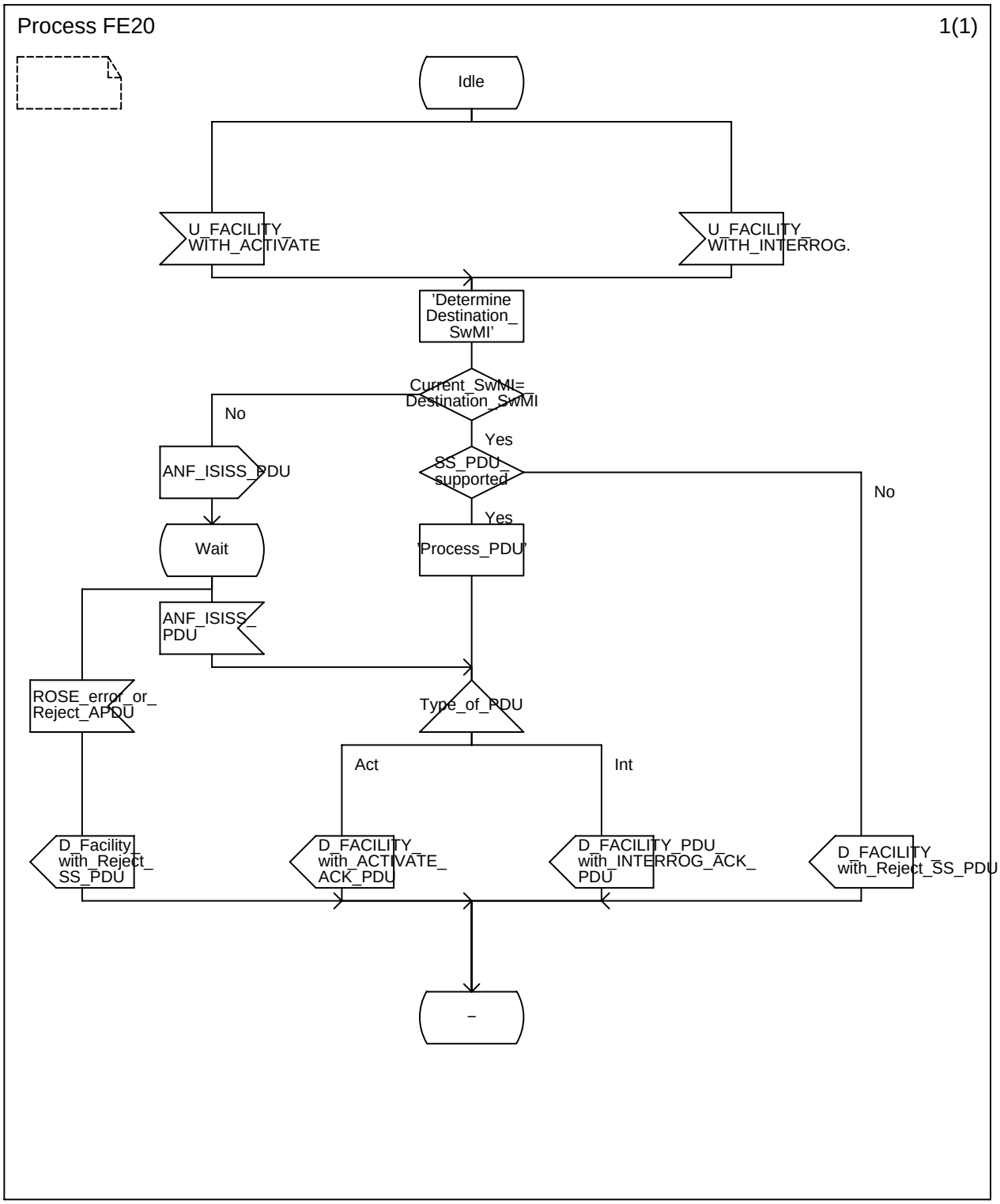
Depending on whether or not this SwMI is also the managed user home SwMI, it is or it not the destination SwMI of the ACTIVATE, DEACTIVATE or INTERROGATE PDUs sent by the authorized user MS/LS.

Input signals from the right represent PDUs received from the managed user home SwMI.

Output signals to the right represent PDUs sent to the managed user home SwMI.

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

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



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.

Figure 47: SDL for Functional Entity FE20

NOTE 1: In the case where the served user would have some (limited) authorized user capabilities, the SDL in figure 47 would be applicable to the SwMI where this user is registered.

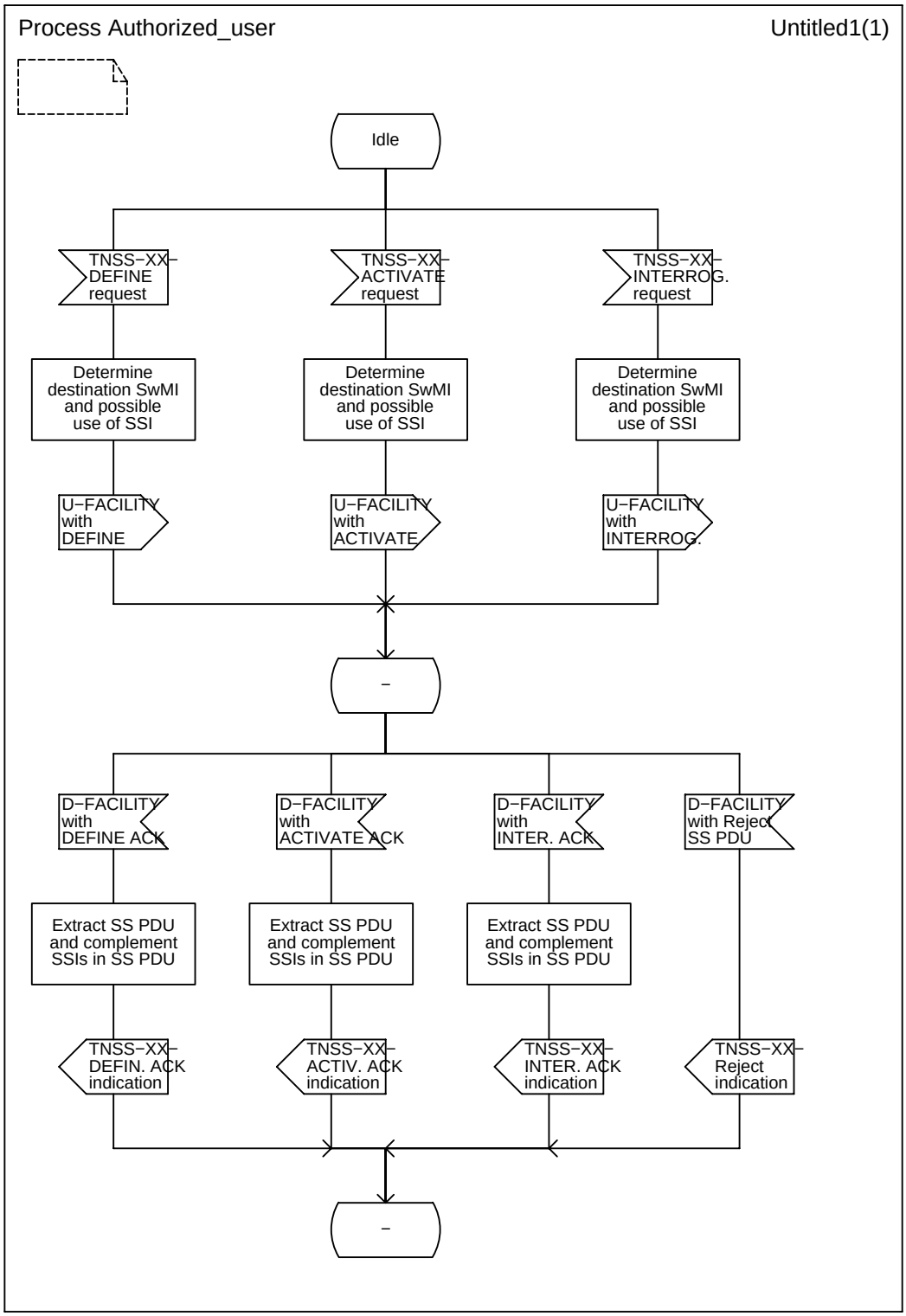
NOTE 2: In the case where a user involved in the invocation or operation of some supplementary service would be registered in the same SwMI as the authorized user, the SDL applicable to the SwMI where the former user is registered would apply in addition to figure 47 to the SwMI where the authorized user is registered.

4.1.4.10 Behavior of FE3

Figure 48 shows the behavior of the supplementary service control entity within the authorized user MS/LS.

Input signals from the right and output signals to the right represent air interface PDUs.

Input signals from the left and output signals to the left represent primitives to the authorized user.



NOTE: In the case where the served user would have some (limited) authorized user capabilities, this SDL would be applicable to the served user MS/LS.

Figure 48: SDL for Functional Entity FE3

4.1.4.11 Behavior of FE22

Figures 49 and 50 contain the SDL diagram for the functional entity FE22.

Input signals from the left represent information flows from other functional entities or primitives from local CC.

Input signals from the right represent information flows from other functional entities or internal stimuli.

Output signals to the right and to the left represent information flows to other functional entities.

The relationship to the basic call process is also indicated in task symbols or in the annotations.

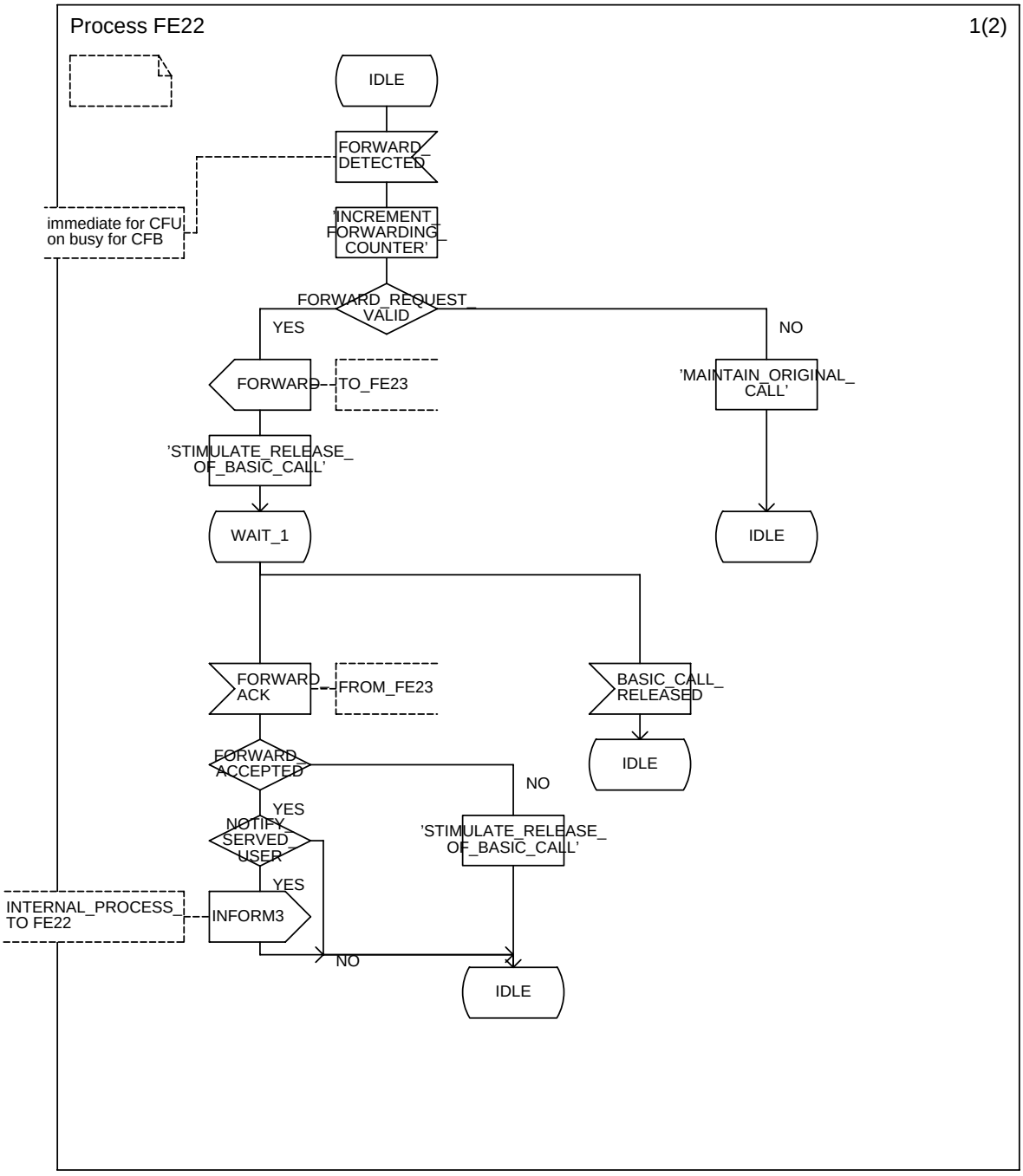


Figure 49: SDL for Functional Entity FE22 (part 1)

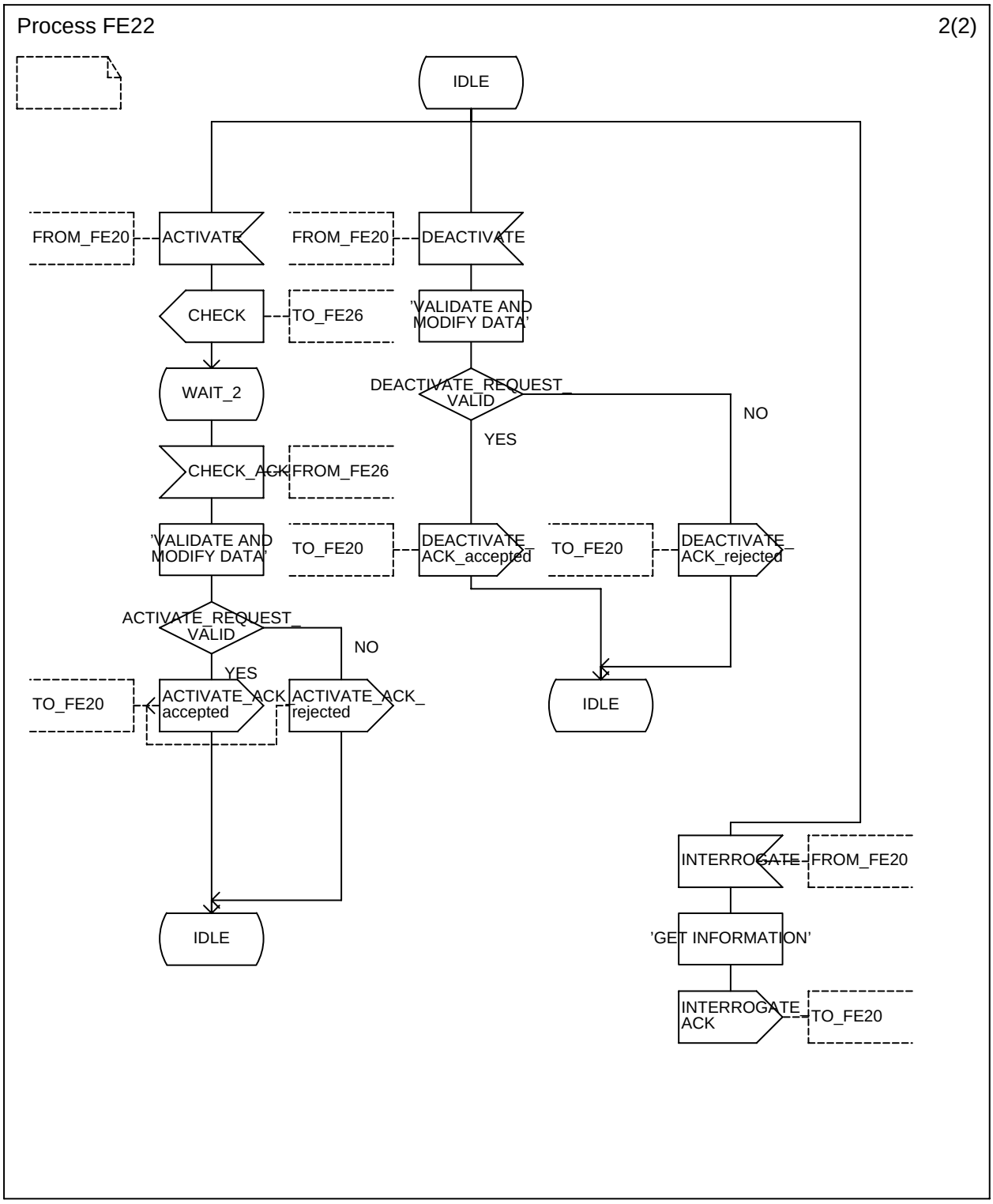


Figure 50: SDL for Functional Entity FE22 (part 2)

4.1.5 Allocation of functional entities to physical equipment

The allocation of FEs to physical locations as shown in tables 23, 24 and 25 shall apply. In these tables, "TE" indicates a TE attached to a SwMI. Where a terminal involved is stimulus with respect to call forwarding, any FE shown as residing in the corresponding user's TE, shall reside instead in that user's SwMI.

Table 23: Allocation for call forwarding operation by "re-routeing"

	User A FE5	User A FE25	FE25	User B FE21	User B FE1	User C FE26	User C FE6
Scenario 1	MS/LS	SwMI	Originating SwMI	SwMI	MS/LS	SwMI	MS/LS
Scenario 2	MS/LS	SwMI	Originating SwMI	SwMI	MS/LS	other network	other network
Scenario 3	other network	other network	Gateway SwMI	SwMI	MS/LS	SwMI	MS/LS
Scenario 4	other network	other network	Gateway SwMI	SwMI	MS/LS	other network	other network

Table 24: Allocation for call forwarding activation/deactivation and interrogation

	Served User B		De/activating User Interrogating User	
	FE21	FE1	FE20	FE3
Scenario 5	SwMI	MS/LS	User B Home SwMI	MS/LS
Scenario 6	SwMI	MS/LS	any SwMI	MS/LS
Scenario 7	other network	TE	other network	TE

Table 25 shows the allocation of functional entities to physical equipment.

Table 25: Scenarios for the allocation of FEs for Forward Counter to physical equipment

	FE21	FE2x (intermediate)	FE2x (final)
Scenario 1	Originating SwMI	Forwarding SwMI	Terminating SwMI
Scenario 2	Forwarding SwMI	Forwarding SwMI	Terminating SwMI

4.1.6 Inter-working considerations

In cases where FE25 or FE26 is in another network, information pertaining to relationship rb, rc or re shall be passed as appropriate to the other network by the Gateway SwMI, except any restricted number information. In cases where FE21 is in another network, information pertaining to relationship rx shall be passed to the other network by the Gateway SwMI, if the other network supports the equivalent information flow.

In cases where information is received from a FE located in another network by a Gateway SwMI, the information required for SS-CFU, SS-CFB, SS-CFNRy and SS-CFNRc shall be used by that SwMI.

NOTE: SS-CFNRc may not have any equivalent supplementary service in a fixed type of other network; in that case the gateway SwMI will have to map the SS-CFNRc related flows into flows that can be understood by the other network such as those of SS-CFNRy.

FC applies only to portions of a call that lie within the TETRA Network. For calls to and from other networks the functional entities are allocated to physical equipment as shown in table 26.

Table 26: Scenarios for the allocation of FEs to physical equipment in interworking situations

	FE21	FE2x (intermediate)	FE2x(final)
Scenario 3	Originating SwMI	Forwarding SwMI	Outgoing Gateway SwMI
Scenario 4	Forwarding SwMI	Forwarding SwMI	Outgoing Gateway SwMI
Scenario 5	Incoming Gateway SwMI	Forwarding SwMI	Terminating SwMI
Scenario 6	Incoming Gateway SwMI	Forwarding SwMI	Outgoing Gateway SwMI

4.2 Case of forward switching

This subclause defines the stage 2 of the Call Forwarding supplementary services (CFU, CFB, CNFRy and CFNRc) using the "forward switching" network routeing algorithm. The term CF used here indicates that unless otherwise noted, the specification applies to all four supplementary services.

NOTE: The text concerning FC (Forward Counter) is not repeated here.

4.2.1 Functional model

4.2.1.1 Functional model description

4.2.1.1.1 SS-CF management

Clause 4.1.1.1.1 shall apply.

4.2.1.1.2 Individual Calls

The functional model shall comprise the following functional entities (FEs):

- FE5: Calling user's service agent;
- FE25: Calling user's service control entity;
- FE21: Call diversion detection and control entity; Call diversion execution entity;
- FE1: Served user's service agent;
- FE26: Diverted-to user's service control entity;
- FE6: Diverted-to user's service agent;
- FE20: User's activation, deactivation and interrogation control entity;
- FE3: User's activation, deactivation and interrogation agent.

The following functional relationships shall exist between these FEs:

- ra: between FE5 and FE25;
- rb: between FE25 and FE21;
- rd: between FE21 and FE1;
- re: between FE21 and FE26;
- rf: between FE26 and FE6;
- ry: between FE21 and FE20;
- rx: between FE20 and FE3.

Different types of call diversion (e.g. CFU, CFB, CFNRy and CFNRc) may be concatenated during multiple call diversion as well as different network routeing algorithms (call diversion by "forward switching" and call diversion by "re-routeing").

4.2.1.1.2.1 Single stage of call forwarding

Figure 51 shows the FEs and relationships for a single stage of call forwarding.

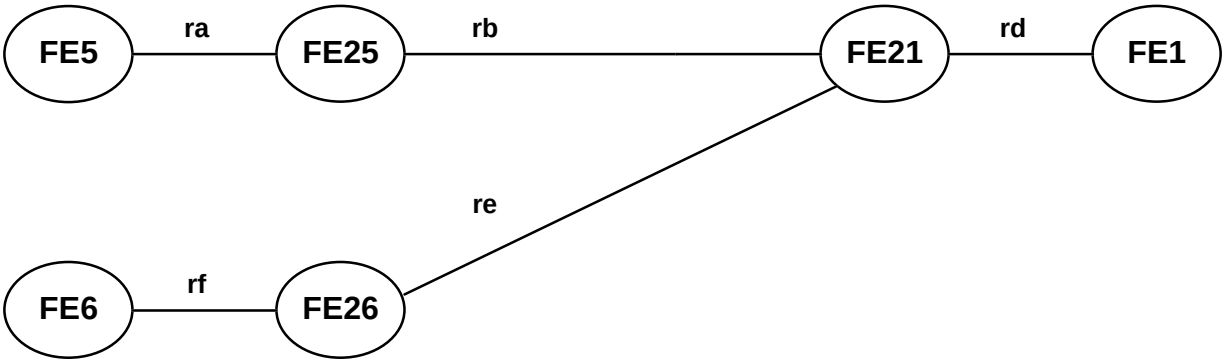


Figure 51: Functional Entity Model for Individual Call, Single Stage of Call Forwarding and Forward Switching

4.2.1.1.2.2 Double stage of call forwarding

Figure 52 shows the FEs and relationships for two stages of call forwarding and individual call.

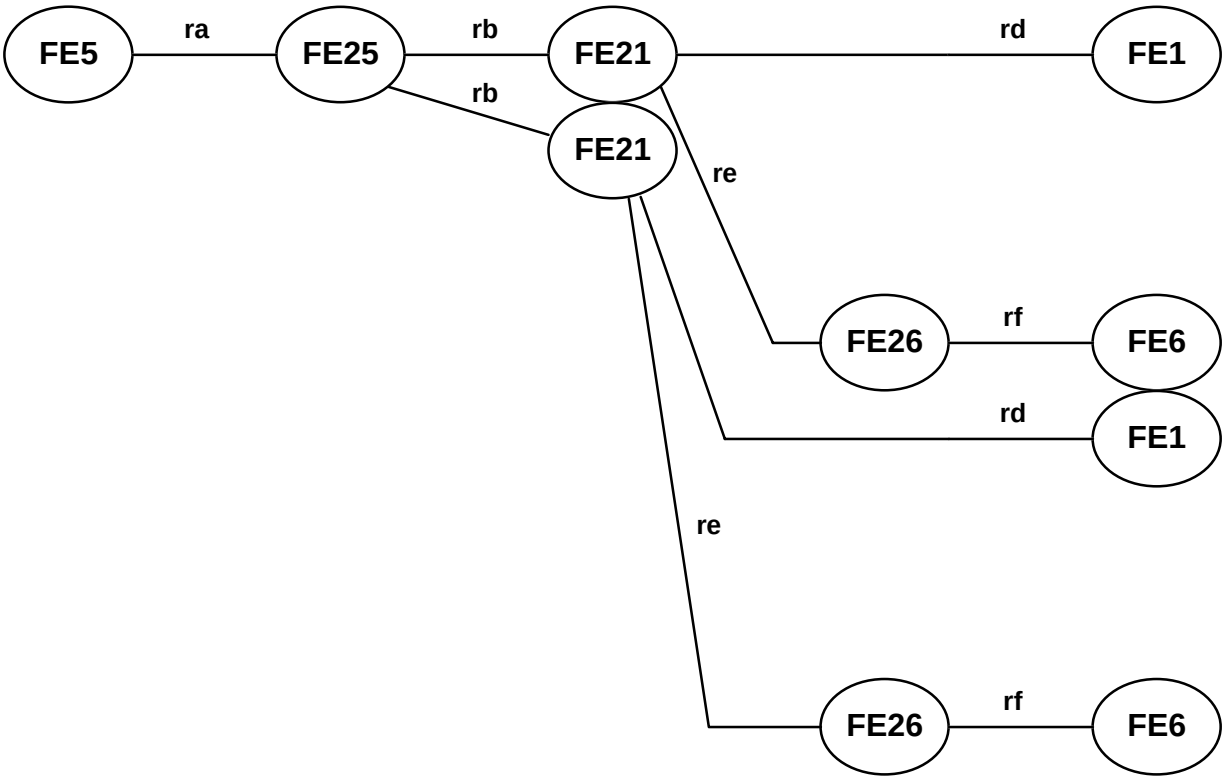


Figure 52: Functional Entity Model for Individual Call and Two Stages of Call Forwarding

4.2.1.2 Description of the functional entities

4.2.1.2.1 Calling user's service agent, FE5

This FE delivers the call forwarding notifications to the calling user.

4.2.1.2.2 Calling user's service control entity, FE25

This FE provides the appropriate call forwarding notifications to FE5 according to the information received from FE21 and FE26.

4.2.1.2.3 Void

4.2.1.2.4 Served user service control entity; call forwarding detection, FE21

This FE detects a call forwarding request and supervises this request. FE21 provides a notification to FE1 and provides internal call forwarding information. FE 21 also receives activation, deactivation and interrogation requests from FE20 and provides responses to FE20. FE21 is responsible for modifying data related to activation, deactivation and authorized user activation enabling and disabling.

This FE executes call forwarding by initiating a new call establishment, and requesting release of the leg to the original called user. FE21 also relays call forwarding information to FE25 and FE26.

4.2.1.2.5 Served user service agent, FE1

This FE delivers call forwarding notifications to the served user.

4.2.1.2.6 Forwarded-to user service control entity, FE26

This FE provides appropriate call forwarding notifications to FE6 and provides also number presentation restriction information to FE25 via FE21.

4.2.1.2.7 Forwarded-to user service agent, FE6

This FE delivers call forwarding notification to the forwarded-to user.

4.2.1.2.8 Managed user activation, deactivation and interrogation control, FE20

This FE relays activation, deactivation and interrogation requests and responses between FE3 and FE21.

4.2.1.2.9 Managed user activation, deactivation and interrogation agent, FE3

This FE provides activation, deactivation and interrogation requests to FE20 and delivers corresponding responses to the requesting user.

4.2.1.3 Relationship of functional model to basic call functional model

Functional entity FE5 shall be collocated with user A's CCA.

Functional entity FE25 shall be collocated with user A's CC or with any Incoming Gateway CC.

Functional entity FE21 shall be collocated with user B's CC (users B1 ... Bn in case of multiple call forwarding) in the case of call forwarding by forward switching.

Functional entity FE1 shall be collocated with user B's CCA.

Functional entity FE26 shall be collocated with user C's CC, and also with the CCs for users B2 ... Bn in case of multiple call forwarding.

Functional entity FE6 shall be collocated with user C's CCA.

Functional entity FE20 shall be collocated with either the served user B's CC or any authorized user's CC.

Functional entity FE3 shall be collocated with either the served user B's CCA or any authorized user's CCA.

An example of the relationship with a basic service is shown in figure 53. This example is used as the basis for the information flow sequence diagrams in subclause 4.2.2.2.

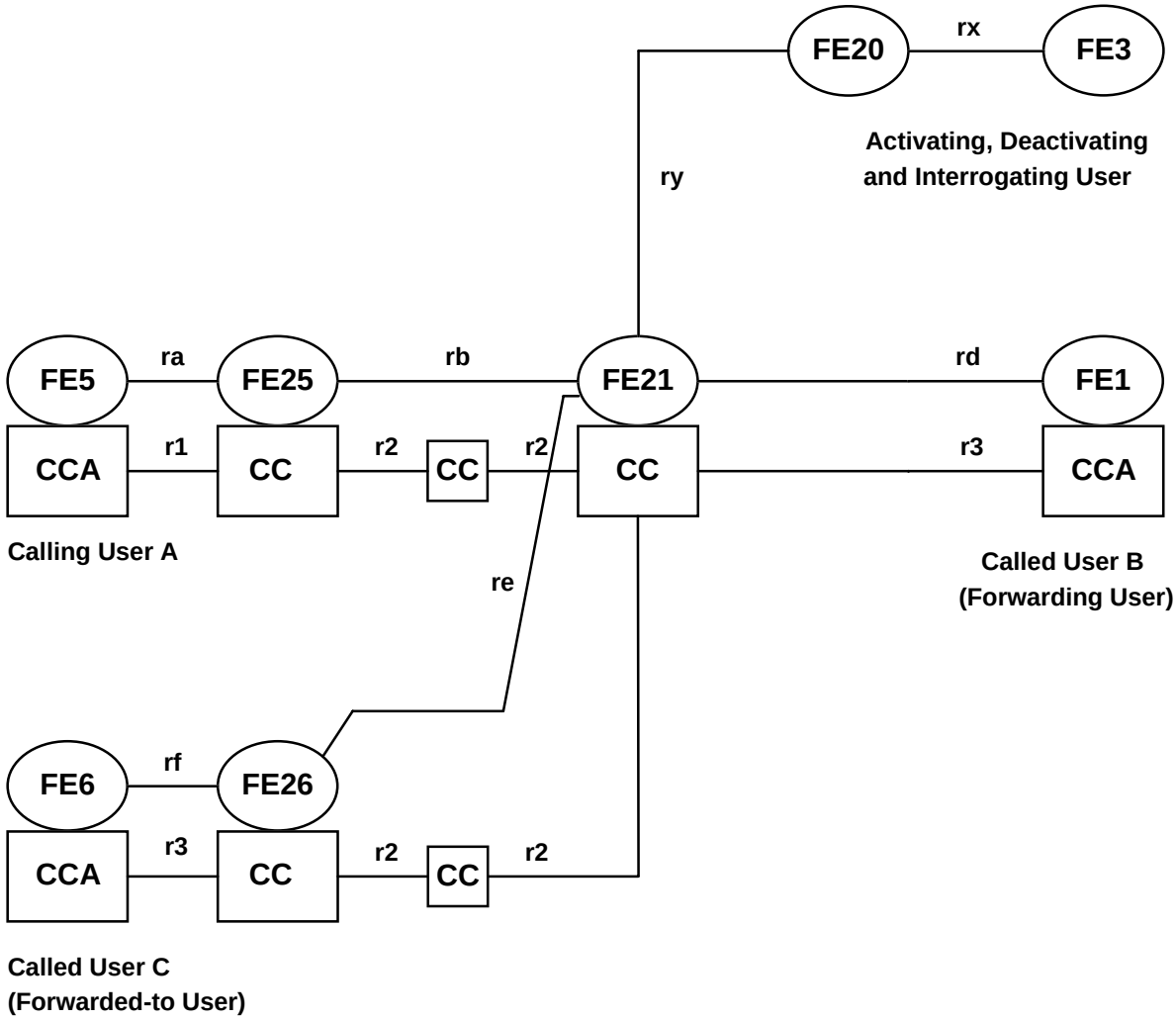


Figure 53: Functional Entity Model Relationship, Individual Call, Forward switching

4.2.1.4 Service primitives

Clause 4.1.14 of this ETS shall apply.

4.2.2 Information Flows

4.2.2.1 Definition of information flows

NOTE: The missing numbers in the INFORM sequence are to respect the ECMA numbering; those INFORMx information flows that appeared in ECMA and do not appear in this ETS are skipped.

4.2.2.1.1 ACTIVATE

See subclause 4.1.2.1.1.

4.2.2.1.2 ACTIVATE ACK

See subclause 4.1.2.1.2.

4.2.2.1.3 DEACTIVATE

See subclause 4.2.1.1.3.

4.2.2.1.4 DEACTIVATE ACK

See subclause 4.1.2.1.4.

4.2.2.1.5 DISABLE

Clause 4.1.2.1.5 of this ETS shall apply.

4.2.2.1.6 DISABLE ACK

Clause 4.1.2.1.6 of this ETS shall apply.

4.2.2.1.7 ENABLE

Clause 4.1.2.1.7 of this ETS shall apply.

4.2.2.1.8 ENABLE ACK

This unconfirmed information flow gives the result of the enabling of the authorized user call forwarding activation. It may be sent over relationship rd and it shall contain the service elements listed in table 8 of subclause 4.1.2.1.8

4.2.2.1.9 FORWARD

This unconfirmed information flow negotiates call forwarding operation. It shall be sent over relationship rb and it shall contain the service elements listed in table 10 of subclause 4.1.2.1.9.

NOTE: As a result of the merge between ANF-ISI-IC and SS-CF for the routeing method choice; the FORWARD information flow will now belong to ANF-ISI-IC and is recalled here for reader`s convenience.

4.2.2.1.10 FORWARD ACK

This unconfirmed information flow gives the result of the call forwarding negotiation. It shall be sent over relationship rb and it shall contain the service elements listed in table 11 of subclause 4.1.2.1.10.

NOTE: As a result of the merge between ANF-ISI-IC and SS-CF for the routeing method choice; the FORWARD ACK information flow will now belong to ANF-ISI-IC and is recalled here for reader`s convenience.

4.2.2.1.11 INFORM 1

This unconfirmed information flow indicates to FE25 that call forwarding has been initiated and informs of calling user notification restrictions (subscription options of user B). It shall be sent over relationship rb and it shall contain the service elements listed in table 12 of subclause 4.1.2.1.11.

4.2.2.1.12 INFORM 2

This unconfirmed information flow indicates to FE5 that call forwarding has been initiated. It shall only be sent if required by the subscription options of user B. It shall be sent over relationship ra.

There is no service element in this information flow.

4.2.2.1.13 INFORM 4

This unconfirmed information flow indicates to FE6 that call forwarding is taking place. It shall be sent over relationship re and it shall contain the service elements listed in table 13 of subclause 4.1.2.1.13.

4.2.2.1.14 INFORM 5

This unconfirmed information flow indicates to FE7 that call forwarding is taking place. It shall be sent over relationship rf and it shall contain the service elements listed in table 14 of subclause 4.1.2.1.14.

4.2.2.1.15 INFORM 6

This unconfirmed information flow indicates whether presentation of user C's number is allowed. It shall be sent over relationship re between FE26 and FE21 and over relationship rb between FE21 and FE25 and it shall contain the service elements listed in table 15 of subclause 4.1.2.1.15.

4.2.2.1.16 INFORM 7

This unconfirmed information flow informs FE5 of the user C's number if appropriate. It shall only be sent if required by the subscription options of user B and if user C's number is not presentation restricted. It shall be sent over relationship ra and it shall contain the service elements listed in table 16 in subclause 4.1.2.1.16.

4.2.2.1.17 INFORM 8

This unconfirmed information flow indicates to FE1 that CFU/CFB/CFNRy/CFNRc has been activated. It shall be sent over relationship rd and it shall contain the service elements listed in table 17 of subclause 4.1.2.1.20.

4.2.2.1.18 INFORM 9

This unconfirmed information flow indicates to FE1 that CFU/CFB/CFNRy/CFNRc has been deactivated. It shall be sent over relationship rd and it shall contain the service elements listed in table 18 of subclause 4.1.2.1.18.

4.2.2.1.19 INTERROGATE

See subclause 4.1.2.1.19.

4.2.2.1.20 INTERROGATE ACK

See subclause 4.1.2.1.20.

4.2.2.2 Examples of information flow sequences

NOTE: Those information flows correspond to the case of forward switching; the functional entity FE23 (routeing entity) of ECMA functional model is created within FE21 as soon as FORWARD ACK is received by FE21.

4.2.2.2.1 Information flow sequences for CFU/CFB operation

The information flow sequence for successful CFU/CFB operation is shown in figure 54.

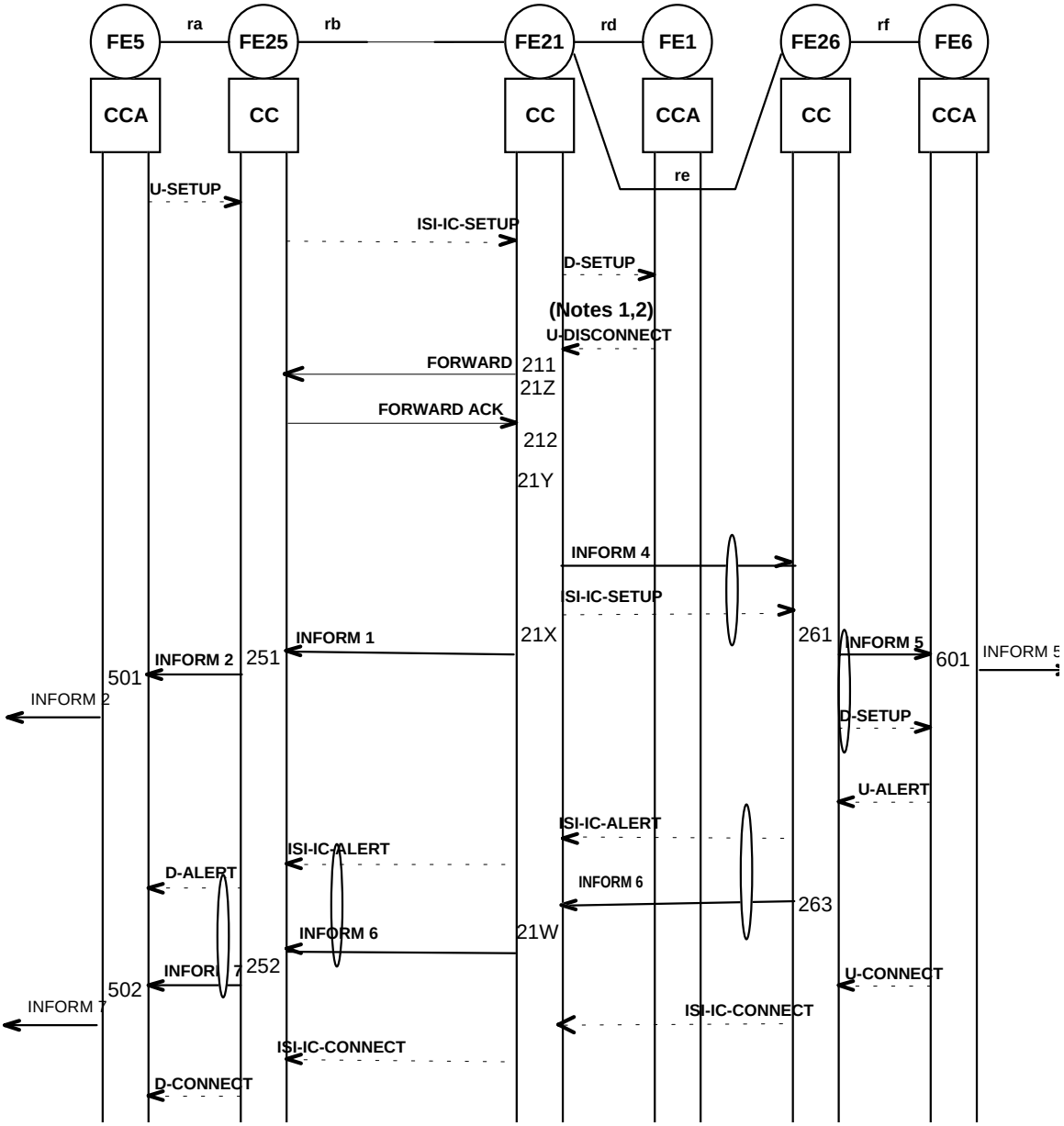
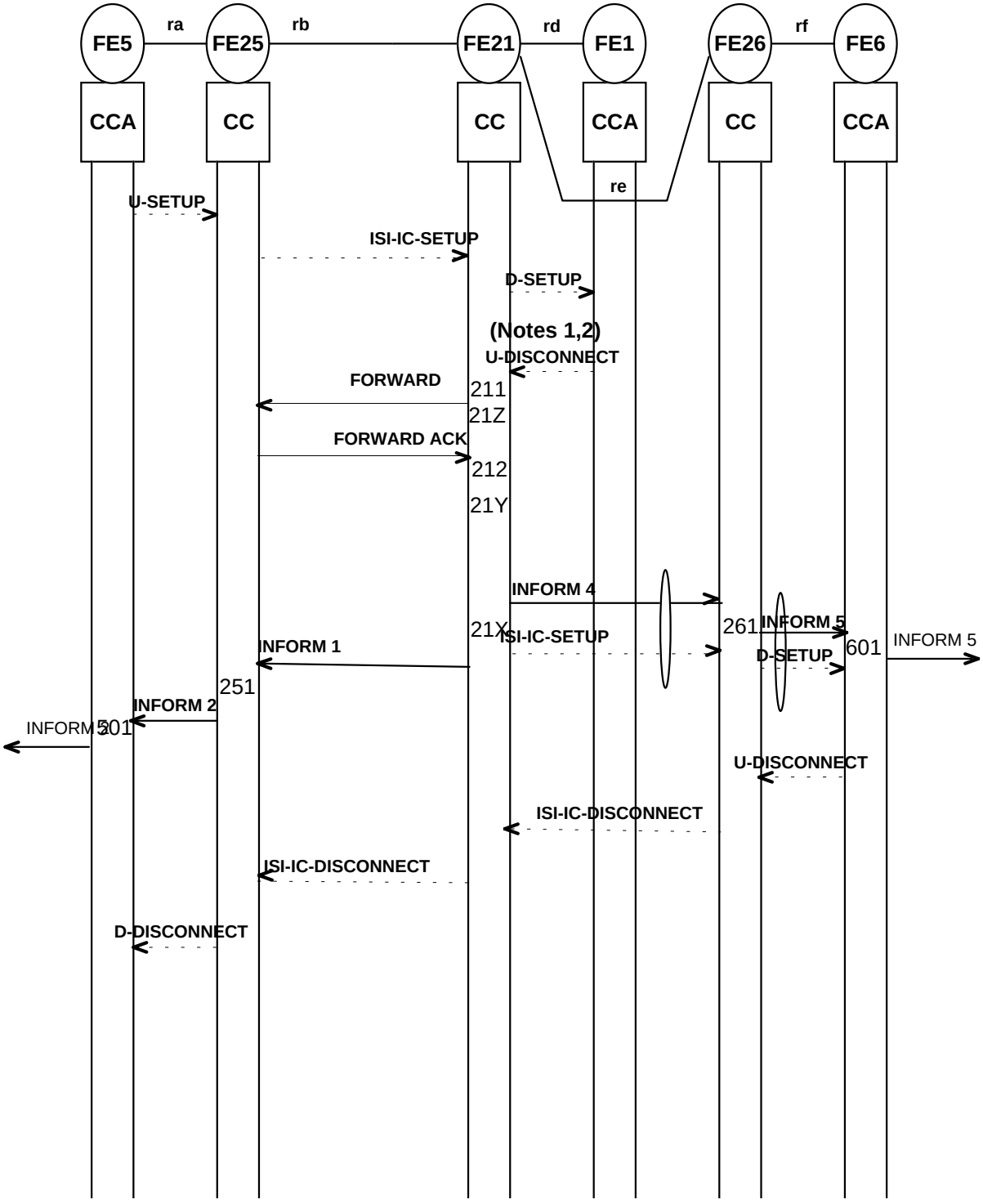


Figure 54: Information Flow Sequence for successful CFU/CFB operation; case of forward switching

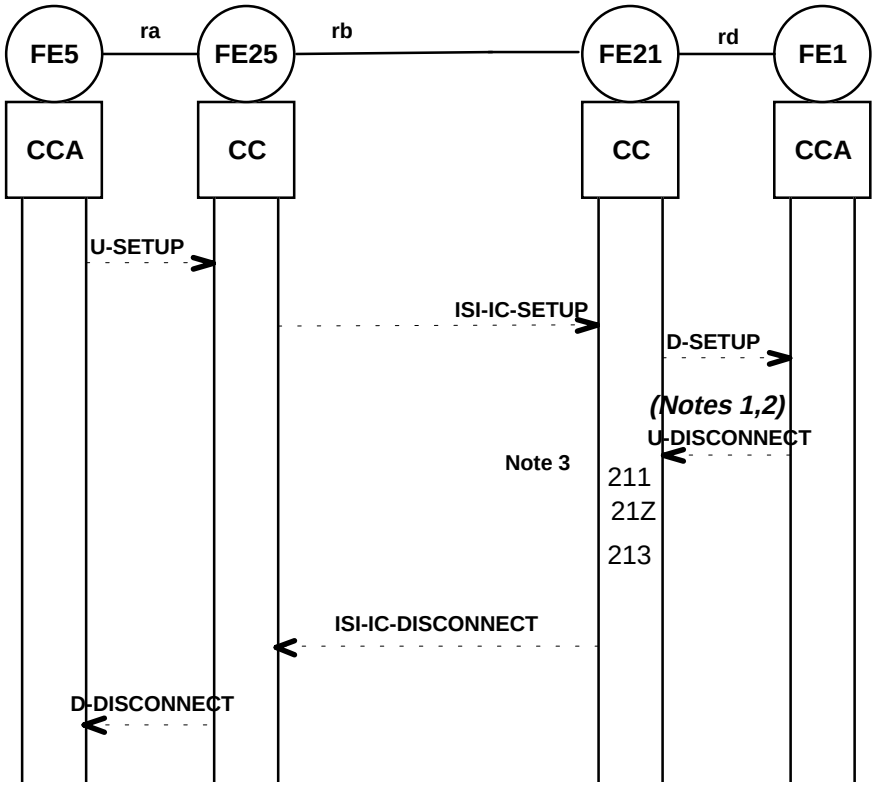
The information flow sequences for unsuccessful CFU/CFB operation are shown in figures 55 and 56.



NOTE 1: This information flow is only applicable in case of CFB-UDUB.

NOTE 2: This information flow does not exist in the case of either CFU or CFB with UDUB.

Figure 55: Information Flow Sequence for unsuccessful CFU/CFB operation: Failure of forwarded call; case of forward switching



NOTE 1: This information flow is only applicable in case of CFB-UDUB.

NOTE 2: This information flow does not exist in the case of either CFU or CFB with UDUB.

Figure 56: Information Flow Sequences for unsuccessful CFU/CFB operation: Rejection of Call Forwarding; case of forward switching

4.2.2.2.2 Information flow sequences for CFNRy operation

The information flow sequence for successful CFNRy operation is shown in figure 57.

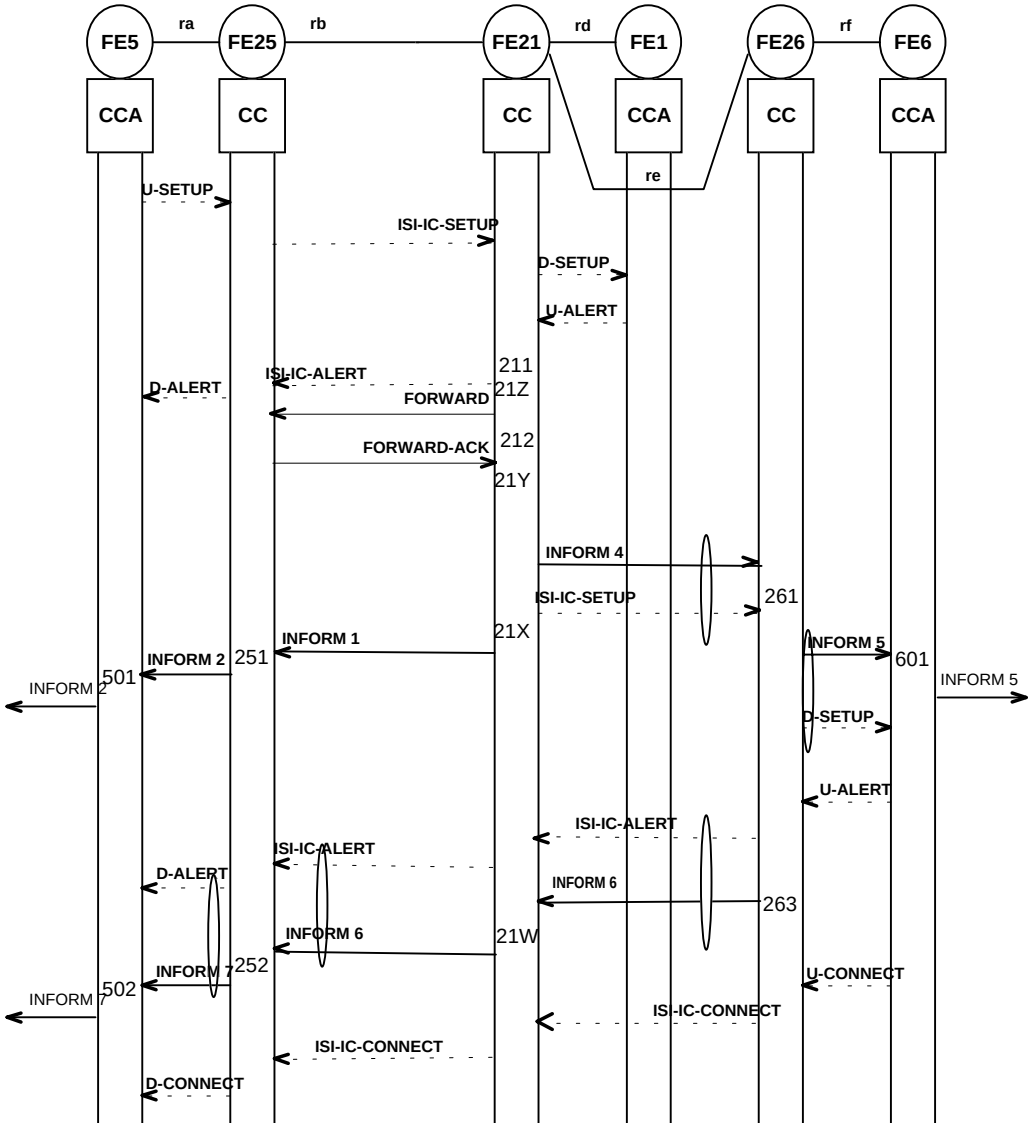


Figure 57: Information Flow Sequence for successful CFNRy operation; case of forward switching

The information flow sequence for clearing by user A during CFNRy operation is shown in figure 58.

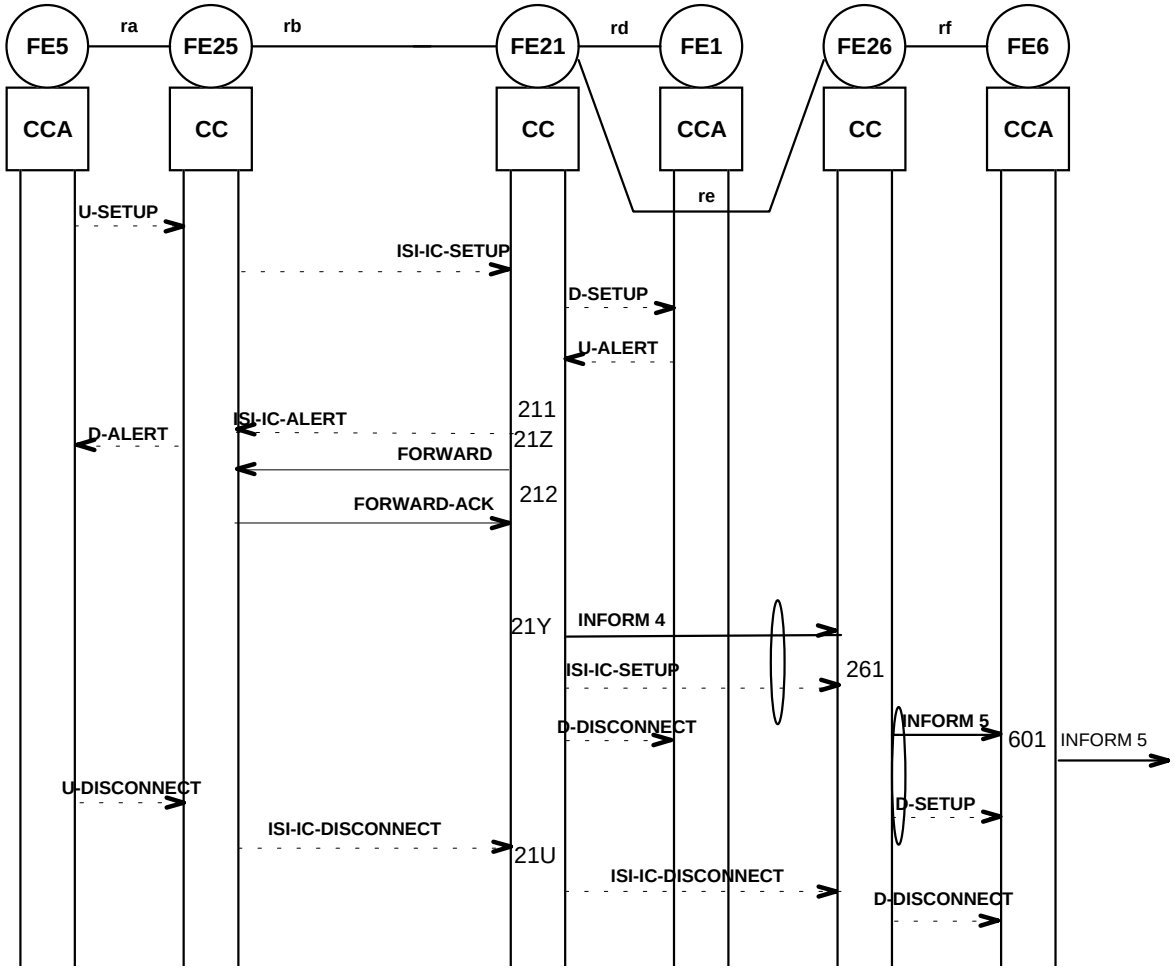


Figure 58: Information Flow Sequence for clearing by user A during CFNRy operation; case of forward switching

The information flow sequences for unsuccessful CFNRy operation are shown in figures 59 and 60.

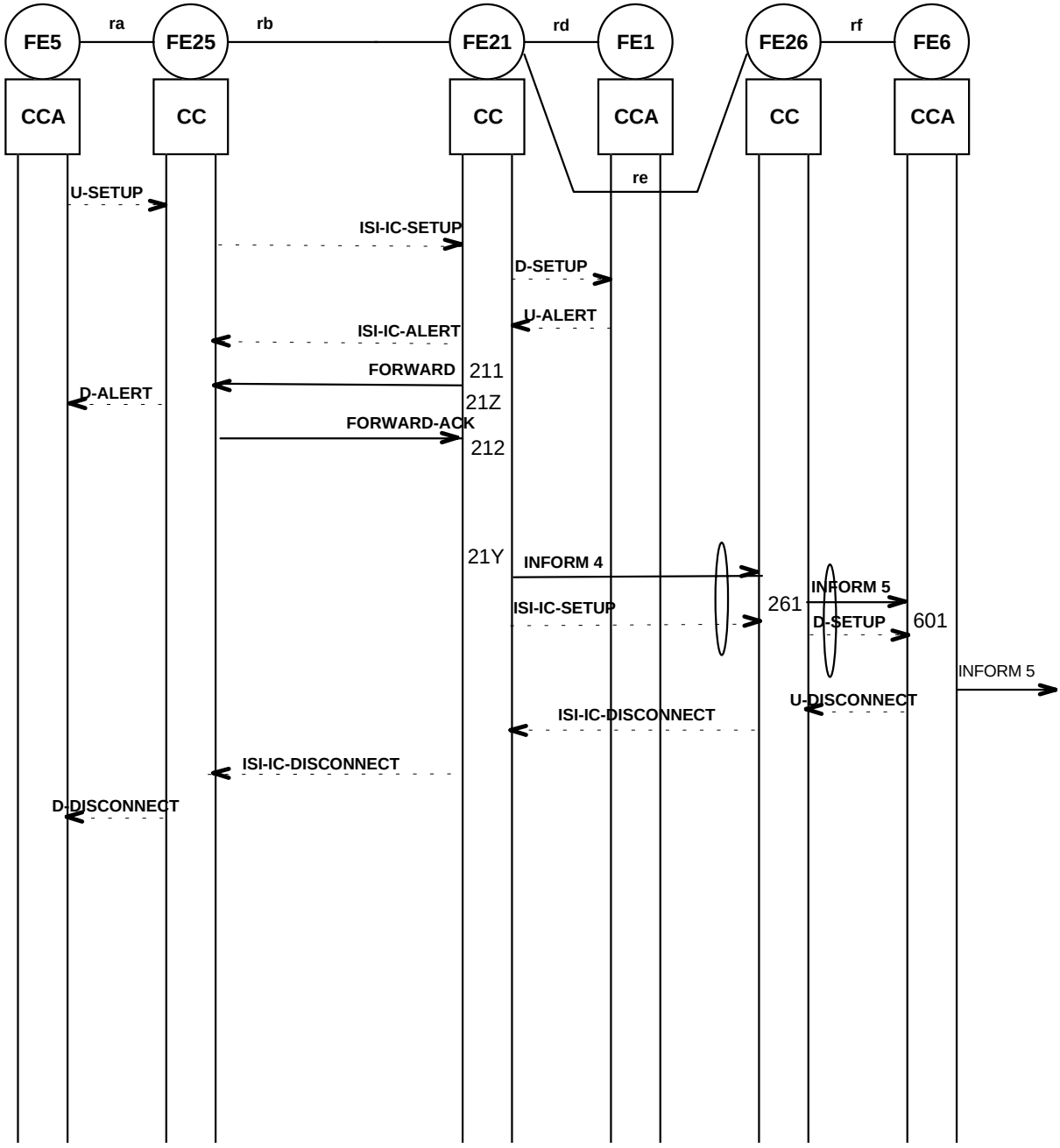


Figure 59: Information Flow Sequences for unsuccessful CFNRy operation: CFNRy not completed, original call cleared; case of forward switching

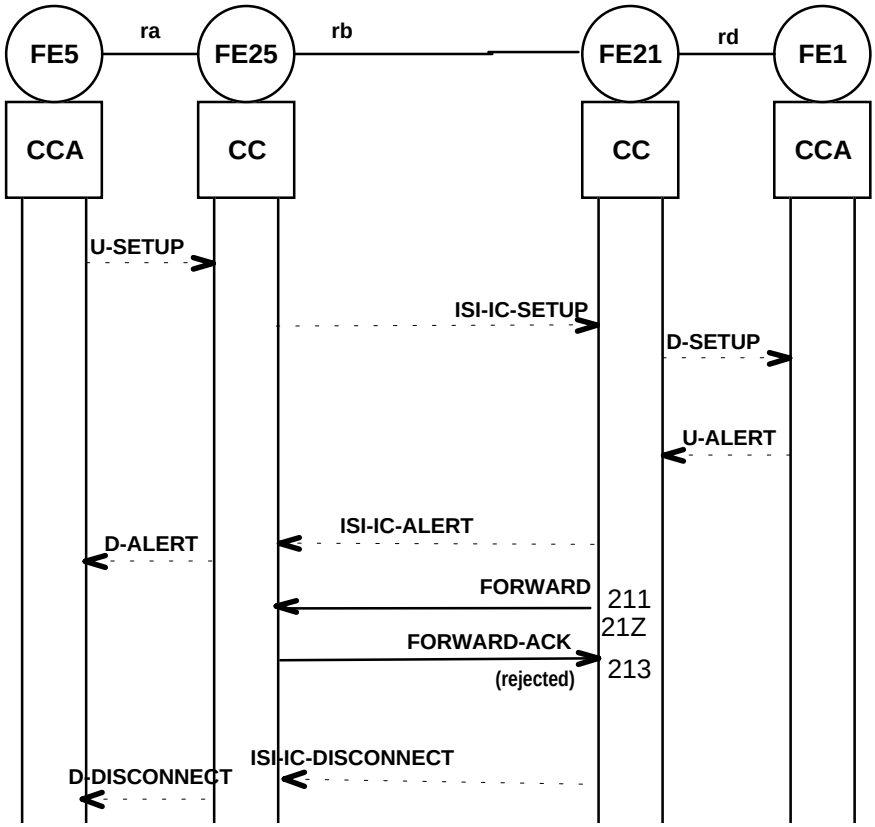
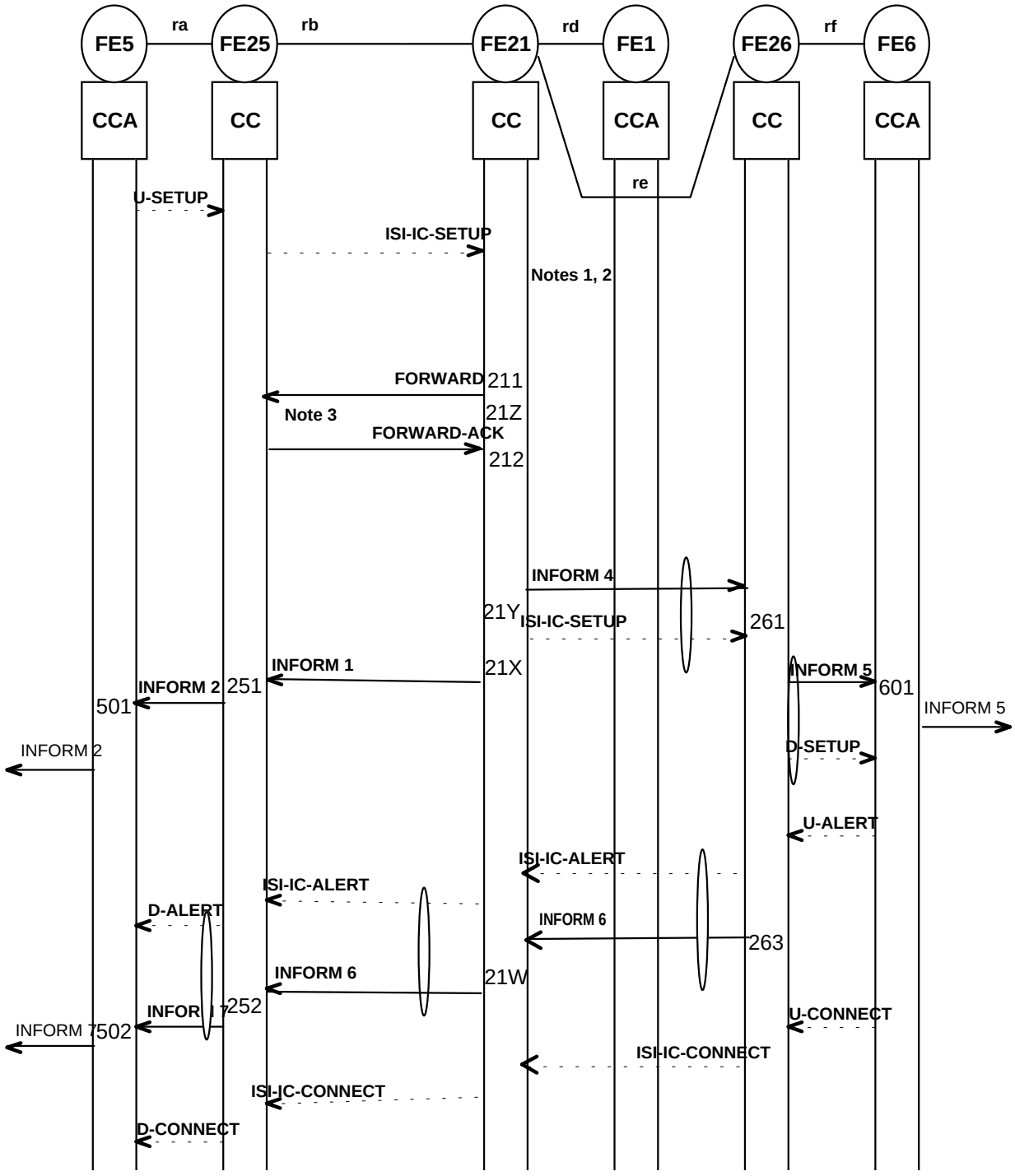


Figure 60: Information Flow Sequences for unsuccessful CFNRy operation: CFNRy rejected, original call cleared; case of forward switching

4.2.2.2.3 Information flow sequences for CFNRc operation

The information flow sequences for CFNRc are not basically different from those for CFNRy; however, those flows are shown for completeness. The information flow sequence for successful CFNRc operation is shown in figure 61.



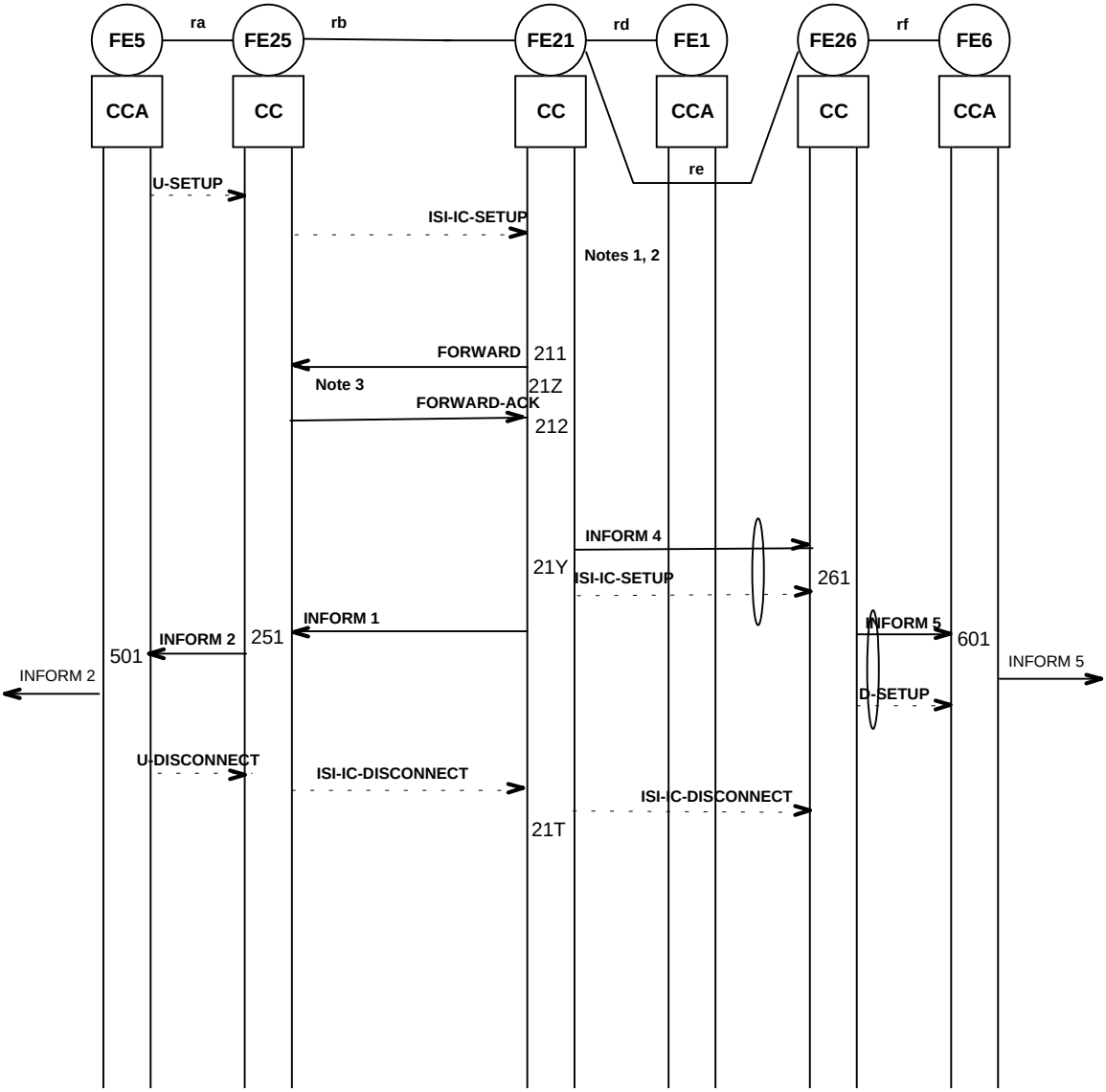
NOTE 1: It is assumed that FE1 remains not reachable during the whole call setup.

NOTE 2: No INFORM information flow can be transferred.

NOTE 3: The call forwarding invocation inhibits the ISI-DISCONNECT with cause User Not Reachable which would normally be sent.

Figure 61: Information Flow Sequence for successful CFNRc operation; case of forward switching

The information flow sequence for clearing by user A during CFNRc operation is shown in figure 62.



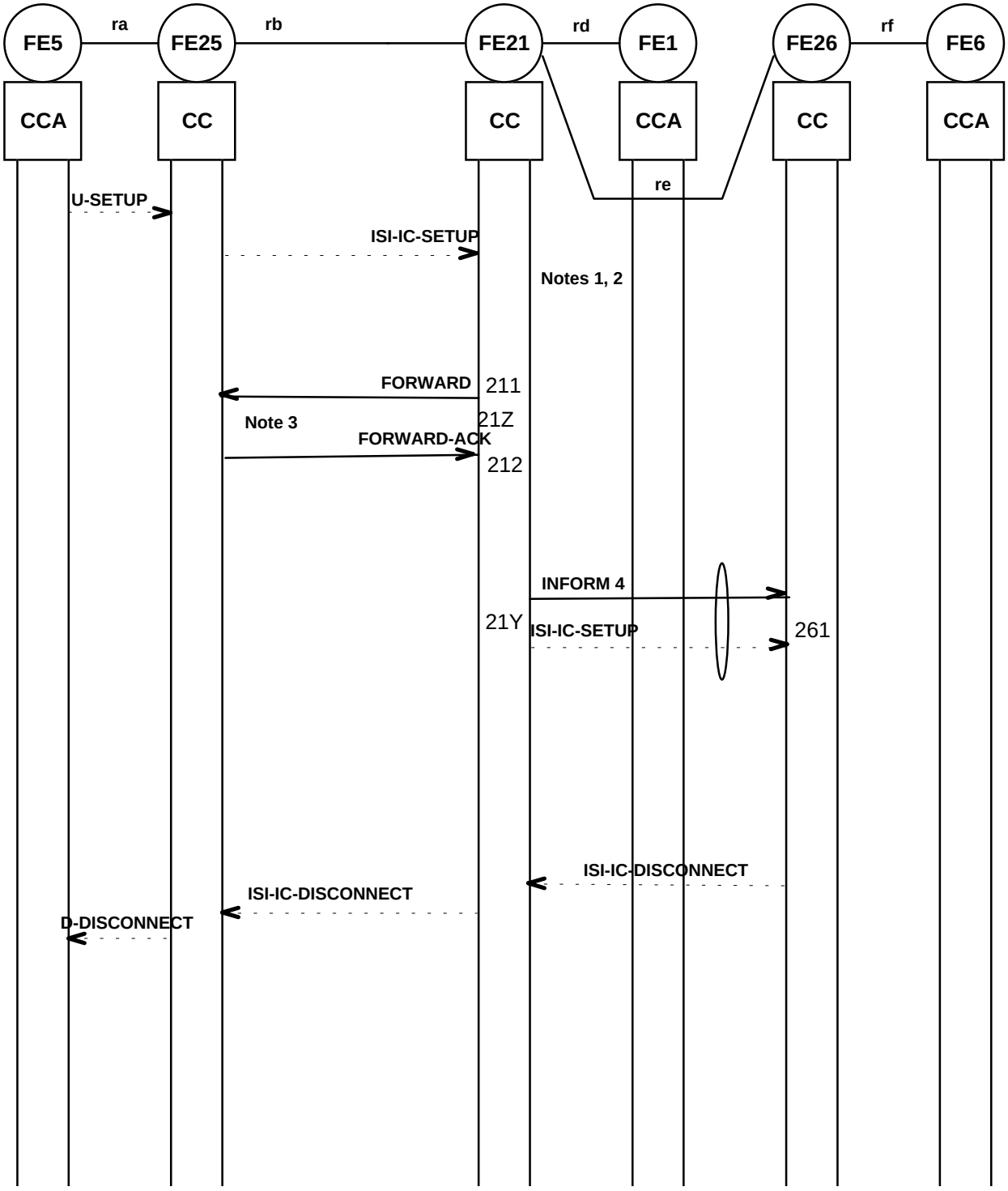
NOTE 1: It is assumed that FE1 remains not reachable during the whole call setup.

NOTE 2: No INFORM information flow can be transferred.

NOTE 3: The call forwarding invocation inhibits the ISI-DISCONNECT with cause User Not Reachable which would normally be sent.

Figure 62: Information Flow Sequence for clearing by user A during CFNRc operation; case of forward switching

The information flow sequences for unsuccessful CFNRc operation are shown in figures 63 and 64.

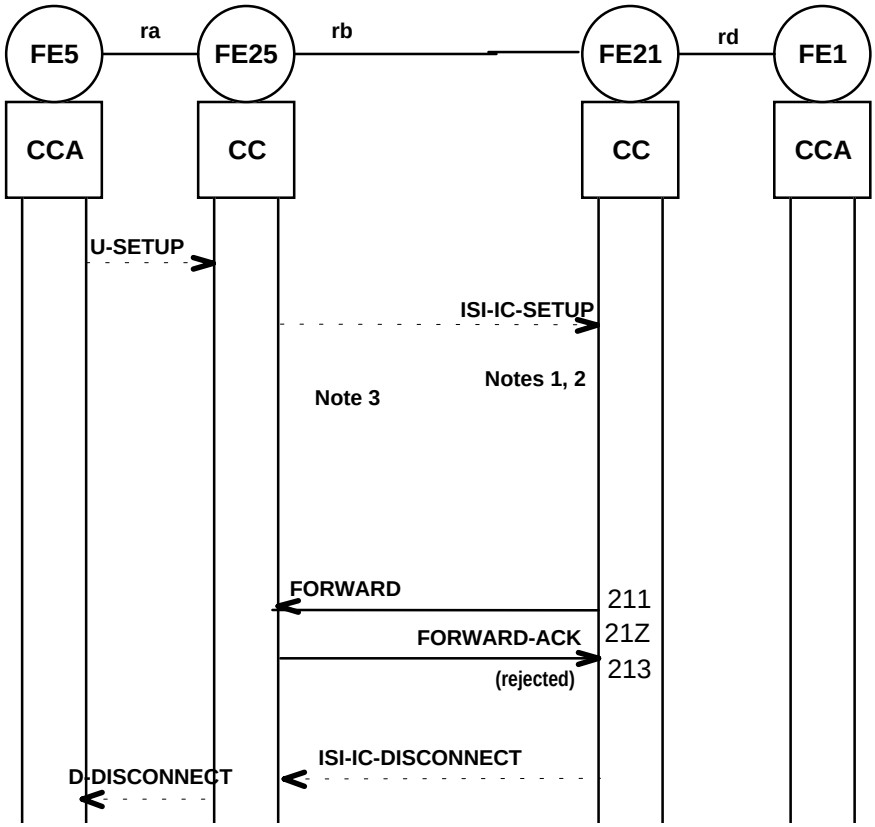


NOTE 1: It is assumed that FE1 remains not reachable during the whole call setup.

NOTE 2: No INFORM information flow can be transferred.

NOTE 3: The call forwarding invocation inhibits the ISI-DISCONNECT with cause User Not Reachable which would normally be sent.

Figure 63: Information Flow Sequences for unsuccessful CFNRc operation: CFNRc not completed, original call cleared; case of forward switching



NOTE 1: It is assumed that FE1 remains not reachable during the whole call setup.

NOTE 2: No INFORM information flow can be transferred.

NOTE 3: The call forwarding invocation inhibits the ISI-DISCONNECT with cause User Not Reachable which would normally be sent.

Figure 64: Information Flow Sequences for unsuccessful CFNRy operation: CFNRc rejected, original call cleared; case of forward switching

4.2.2.2.4 Information flow sequences for two stage forwarding, individual call, forward switching

As an illustration of how a double stage individual call forwarding would operate in the case of forward switching, the information flow sequence is given in figure 65.

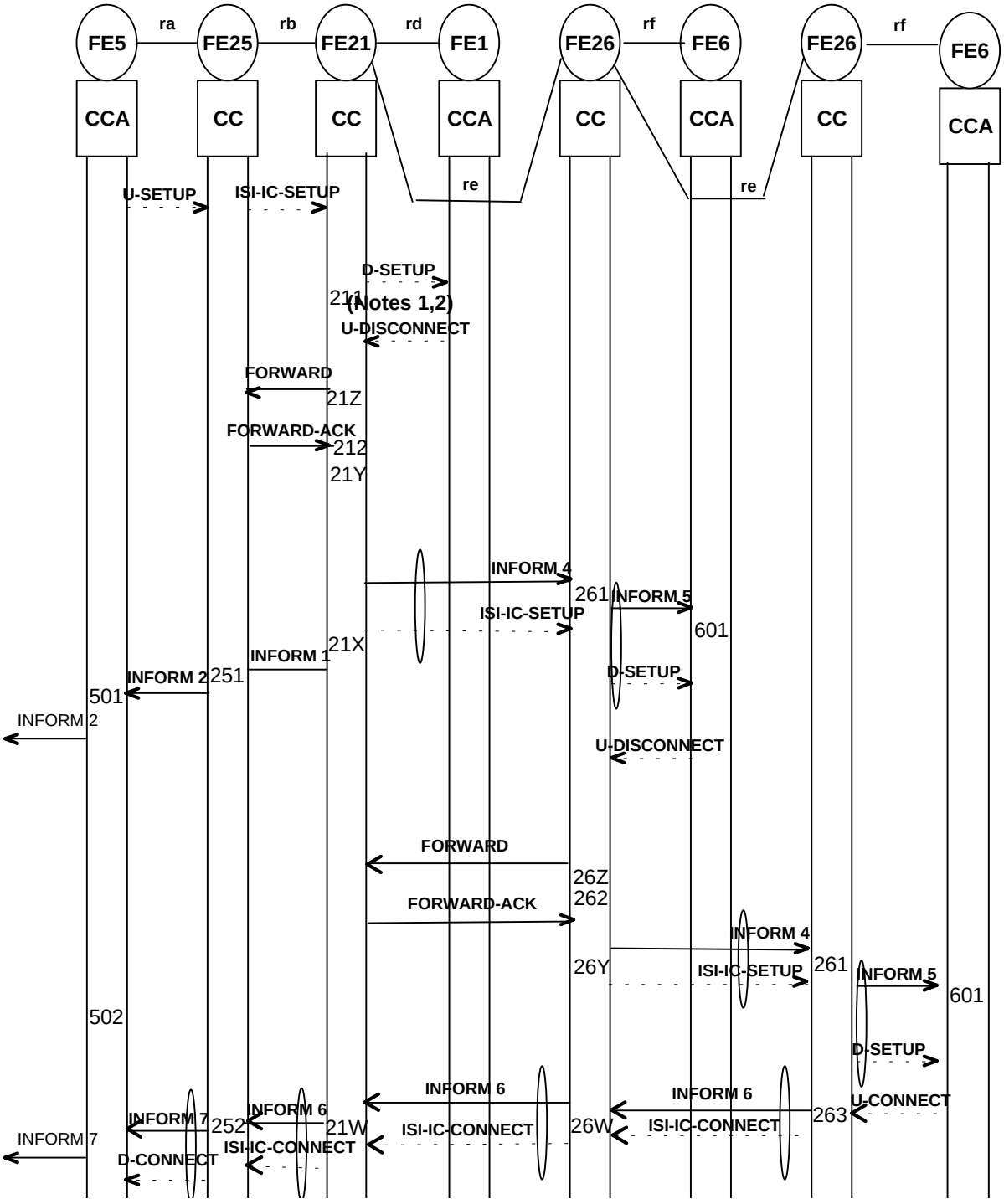


Figure 65: Information Flow Sequences for successful CFU double stage operation; case of forward switching

4.2.2.2.5 Information flow sequences for SS-CF activation/deactivation

The information flow sequences for activation of SS-CF are the same as in the case of re-routeing; subclause 4.1.2.2.1.5. shall apply.

4.2.2.2.6 Information flow sequence for enabling/disabling of SS-CF authorized user activation/deactivation

The information flow sequences for enabling/disabling of SS-CF activation/deactivation authorized user is the same as in the case of re-routeing; subclause 4.1.2.2.1.6 shall apply.

4.2.2.2.7 Information flow sequence for SS-CF interrogation

The information flow sequences for interrogation of SS-CF are the same as in the case of re-routeing; subclause 4.1.2.2.1.7 shall apply.

4.2.3 Functional entity actions

The following FEAs shall occur at the points indicated in the figures of subclause 4.2.2:

4.2.3.1 Actions of FE1

102 Deliver notifications on activation and deactivation to the user as received from FE21.

103 Send ENABLE/DISABLE to FE21 as received from the served user.

104 Deliver ENABLE-ACK/DISABLE-ACK to the served user as received from FE21.

107 Inform the user that CFNRy/CFNRc has failed.

4.2.3.2 Actions of FE3

301 Send activation/deactivation/interrogation requests to FE20 as received from the user.

302 Deliver activation/deactivation/interrogation responses to the user as received from FE20.

4.2.3.3 Actions of FE5

501 Deliver call forwarding notifications to the user as received from FE25 in INFORM 2 .

502 Deliver number notification to the user as received in INFORM 7 from FE25.

4.2.3.4 Actions of FE6

601 Deliver notifications to the forwarded-to user as received from FE26.

4.2.3.5 Actions of FE20

201 Receive ACTIVATE from FE3. Perform address checking and either relay the ACTIVATE to FE21 or send a negative ACTIVATE ACK to FE3.

202 Receive ACTIVATE ACK from FE21 and relay it to FE3.

203 Receive DEACTIVATE from FE3. Perform address checking and either relay the DEACTIVATE to FE21 or send a negative DEACTIVATE ACK to FE3.

204 Receive DEACTIVATE ACK from FE21 and relay it to FE3.

205 Receive INTERROGATE from FE3. Perform address checking and either relay the INTERROGATE to FE21 or send a negative INTERROGATE ACK to FE3.

206 Receive INTERROGATE ACK from FE21 and relay it to FE3.

4.2.3.6 Actions of FE21

211 Immediate in the case of CFU, on detection of busy in the case of CFB, on detection of Not Reachable in case of CFNRc or after a specified time interval in case of CFNRy:

- recognize call forwarding activated and invoked from Basic Service;
- increment the forwarding counter.

21Z If the incremented forwarding counter has exceeded the upper limit, reject the forwarding request and do the following:

- for CFU/CFB either release the call or override call forwarding (implementation options);
- for CFNR release the original call;
- if the incremented forwarding counter is not above the upper limit, then send a FORWARD to FE25.

212 Receive the positive FORWARD ACK from FE25.

213 Receive the negative FORWARD ACK from FE25. For CFU/CFB/CFNRy/CFNRc: stimulate release of the call to the calling user.

214 Validate received ACTIVATE.

215 Further validate received ACTIVATE and respond to FE20 with ACTIVATE ACK. Inform FE1 of a successful activation (INFORM 8).

216 Validate received ACTIVATE and respond to FE20 with ACTIVATE ACK. Inform F1 of a successful activation (INFORM 8).

217 Validate received DEACTIVATE and respond to FE20 with DEACTIVATE ACK. Inform FE1 of a successful deactivation (INFORM 9).

218 Validate received ENABLE/DISABLE and respond to FE1 with ENABLE-ACK/DISABLE-ACK.

219 Validate received INTERROGATE and respond to FE20 with INTERROGATE ACK.

21Y In the case where the FORWARD ACK received from FE25 is positive and indicates call forwarding by forward switching, stimulate the basic call establishment to FE26 if the forwarding request is valid. Stimulate the release procedure at leg rc (original call) in case of CFU/CFB. Send INFORM 4 to FE26.

21X Send INFORM 1 to FE25. In case of CFNRy/CFNRc, stimulate the release procedure at leg rc on receipt of ALERT or CONNECT from user C.

21W Relay the presentation indicator received in INFORM 6 from FE26 to FE25.

21T For CFNRy/CFNRc, stimulate release of the legs rc and re if the calling user releases the call.

4.2.3.8 Actions of FE25

251 Receive (multiple) INFORM 1 from FE21 and send each time a call forwarding notification (without number information) in INFORM 2 to FE5 if allowed. Store the notification subscription options and the forwarded-to number.

252 Receive INFORM 6 from FE21, get the stored notification subscription options, determine if presentation of information is allowed and send the appropriate number information in INFORM 7 to FE5 if allowed.

4.2.3.9 Actions of FE26

261 Determine if presentation of the number information received from FE21 in INFORM 4 is allowed and send INFORM 5 to FE6. Store the last forwarding number and original called number and associated presentation restriction indicators for further multiple call forwarding.

263 Send the presentation indicator of the forwarded-to user's number of the forwarded-to user either on receipt of ALERT (alerting) if possible or at latest on CONNECT of the basic call to FE21 in INFORM 6.

In the case of repeated invocation of forward switching:

- 26Z see 21Z above;
- 26Y see 21Y above;
- 26Xsee 21X above.

4.2.4 Functional entity behavior

Subclause 4.1.4 shall apply.

4.2.5 Allocation of functional entities to physical equipment

The allocation of FEs to physical locations as shown in table 27 shall apply. In this table, "TE" indicates a TE attached to a non-TETRA network.

Table 27: Allocation for call diversion operation by "forward switching"

	User A FE5	**User A FE25**	**User B FE21**	**User B FE1**	**User C FE26**	**User C FE6**
Scenario 8	MS/LS	SwMI	SwMI	MS/LS	SwMI	MS/LS
Scenario 9	TE	other network	other network	other network	other network	other network
Scenario 10	other network	other network	SwMI	MS/LS	other network	other network
Scenario 11	other network	other network	other network	other network	SwMI	MS/LS
Scenario 12	TE	other network	other network	other network	SwMI	MS/LS
Scenario 13	MS/LS	SwMI	SwMI	MS/LS	other network	other network
Scenario 14	other network	other network	SwMI	MS/LS	SwMI	MS/LS
Scenario 15	other network	other network	other network	TE	other network	other network
Scenario 16	other network	other network	other network	TE	SwMI	MS/LS
Scenario 17	TE	other network	other network	TE	other network	other network
Scenario 18	TE	other network	other network	TE	PINX	TE
Scenario 19	other network	other network	SwMI	MS/LS	other network	other network
Scenario 20	TE	other network	SwMI	MS/LS	other network	other network
Scenario 21	other network	other network	SwMI	MS/LS	SwMI	MS/LS
Scenario 22	TE	other network	SwMI	MS/LS	SwMI	MS/LS

4.2.6 Inter-working considerations

Subclause 4.1.6 shall apply.

Annex A (informative): Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ETS 300 392-10-4 (1998): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 10: Supplementary services stage 1; Sub-part 4: Call diversion".

- ETS 300 392-9 (1998): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 9: General requirements for supplementary services".

- ETS 300 392-3-1 (1998): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 1: General design".

- ETS 300 392-3-2 (1998): "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)".

- ETS 300 392-3-3 (1998): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 3: Interworking at the Inter-System Interface (ISI); Sub-part 3: Additional Network Functions Group Call (ANF-ISIGC)".

History

Document history			
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