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**Private Telecommunication Network (PTN);
Specification, functional models and information flows
Call transfer supplementary service**

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Foreword

This European Telecommunication Standard (ETS) has been produced by the European Computer Manufacturers Association (ECMA) on behalf of its members and those of the European Telecommunications Standards Institute (ETSI).

This ETS is one of a series of standards defining services and signalling protocols applicable to Private Telecommunication Networks (PTNs) incorporating one or more interconnected nodes. The series uses the ISDN concepts as developed by CCITT and is also within the framework of standards for open systems interconnection as defined by ISO.

This particular ETS specifies the Call Transfer supplementary service.

The ETS is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO, CCITT, ETSI and other international and national standardisation bodies. It represents a pragmatic and widely based consensus.

The service specified is compatible with the equivalent service specified by CCITT and ETSI for public ISDNs. The CCITT stage 1 specification of this service is to be found in Blue Book Recommendation I.252 (part 1). ETSI specifications for public ISDNs are to be found in draft prETS 300 367 (stage 1) and draft prETS 300 368 (stage 2). Annex A describes the relationship between this ETS and the corresponding ETSs for the public ISDN.

This ETS was produced by ECMA using the ECMA guidelines for the production of standards and using the ECMA stylesheet. In order to avoid undue delays in the voting process for this ETS it has been agreed that this ETS will not be converted to the ETSI stylesheet.

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1 Scope

This ETS specifies Supplementary Service Call Transfer (SS-CT), which is applicable to various basic services supported by Private Telecommunication Networks (PTNs). Basic services are specified in ETS 300 171.

SS-CT is a supplementary service which enables a user to transform two of that user's calls into a new call between the other two users of these two calls.

Service specifications are produced in three stages, according to the method described in ENV 41005. This ETS contains the stage 1 and stage 2 specifications of SS-CT. The stage 1 specification (clause 60) specifies the supplementary service as seen by users of PTNs. The stage 2 specification (clauses 70 and 80) identifies the functional entities involved in the supplementary service and the information flows between them.

This ETS contains two stage 2 specifications reflecting different ways of operating the service within the network: transfer by join and transfer by rerouting.

2 Conformance

In order to conform to this ETS, a stage 3 standard shall specify signalling protocols and equipment behaviour that are capable of being used in a PTN which supports the supplementary service specified in this ETS. This means that, to claim conformance, a stage 3 standard is required to be adequate for the support of those aspects of clause 6 (stage 1) and clauses 70 and 80 (stage 2) which are relevant to the interface or equipment to which the stage 3 standard applies.

The requirement that clause 7 (transfer by join) be supported by a stage 3 standard is in order to provide a basic method of implementing SS-CT. The requirement that clause 80 (transfer by rerouting) be supported by a stage 3 standard is in order to provide an optional method of implementing SS-CT which includes an attempt at rerouting the connection between the two transferred users in order to optimise the use of network resources, with fall-back to transfer by join if rerouting is not possible.

3 References

- | | |
|----------------------------|---|
| ENV 41005 | Method for the specification of basic and supplementary services of private telecommunication networks (1989). |
| ENV 41007 | Definition of terms in private telecommunication networks (1989). |
| ETS 300 171 | Private Telecommunication Network (PTN); Specification, functional models and information flows, Control aspects of circuit mode basic services (1992). |
| ETS 300 173 | Private Telecommunication Network (PTN); Specification, functional models and information flows, Identification supplementary services (1992). |
| ETS 300 237 | Private Telecommunication Network (PTN); Specification, functional models and information flows, Name identification supplementary services (1993). |
| CCITT Recommendation I.112 | Vocabulary of terms for ISDNs (1988). |
| CCITT Recommendation I.210 | Principles of telecommunication services supported by an ISDN and the means to describe them (1988). |
| CCITT Recommendation Z.100 | Specification and description language (1988). |

4 Definitions

For the purpose of this ETS the following definitions apply.

4.1 External definitions

This ETS uses the following terms defined in other documents:

- Basic Service (CCITT Recommendation I.210);
- Connection (CCITT Recommendation I.112);
- Private (ENV 41007);
- Private Telecommunication Network Exchange (PTNX)(ENV 41007);
- Public (ENV 41007);
- Public ISDN (ENV 41007);
- Service (CCITT Recommendation I.112);
- Signalling (CCITT Recommendation I.112);
- Supplementary Service (CCITT Recommendation I.210);
- Telecommunication Network (ENV 41007);
- Terminal, Terminal equipment (ENV 41007);
- User (ETS 300 171).

This ETS refers to the following basic call functional entities (FEs) defined in ETS 300 171:

- Call Control (CC);
- Call Control Agent (CCA).

This ETS refers to the following basic call inter-FE relationships defined in ETS 300 171:

- r1;
- r2;
- r3.

This ETS refers to the following basic call information flows defined in ETS 300 171:

- Channel_Acknowledge request/indication;
- Release request/indication;
- Release response/confirmation;
- Setup request/indication;
- Setup response/confirmation.

This ETS refers to the following basic call information flow elements defined in ETS 300 171:

- Call History (CH);
- Connected Number (CN);
- Connected Subaddress (CS);
- Destination Category (DC).

This ETS refers to the following Connected Line Identification Presentation information flow elements defined in ETS 300 173:

- Connected Number (CN);
- Connected Subaddress (CS).

4.2 Additional network feature

A capability, over and above that of a basic service, provided by a PTN, but not directly to a PTN user.

4.3 Alerting

The state of the secondary call when the called user is being alerted but has not yet answered.

- 4.4 Answered**
The state of the primary or secondary call after the called user has answered.
- 4.5 Call, Basic call**
An instance of the use of a basic service.
- 4.6 Primary call**
One of the calls involved in the transfer. In the case of a transfer involving an unanswered call, the primary call is the answered call. In the case where both calls are already answered, the primary call is chosen arbitrarily by the network.
- 4.7 Secondary call**
The other call involved in the transfer.
- 4.8 Transfer by join**
The effecting of transfer by joining together the connections of the primary and secondary calls at user A's PTNX.
- 4.9 Transfer by rerouting**
The effecting of transfer by establishing a new connection to replace all or part of the connections of the primary and secondary calls.
- 4.10 User A**
The served user, i.e. the user requesting Call Transfer.
- 4.11 User B**
The other user in user A's primary call.
- 4.12 User C**
The other user in user A's secondary call.

5 List of acronyms

AI	Alerting Indication
CC	Call Control (functional entity)
CCA	Call Control Agent (functional entity)
CH	Call History (information flow element)
CI	Call Identities (information flow element)
CID	Call Identity (information flow element)
CN	Connected Number (information flow element)
CS	Connected Subaddress (information flow element)
CUG	Closed User Group
DC	Destination Category (information flow element)
ED	End Designation (information flow element)
FE	Functional Entity
ISDN	Integrated Services Digital Network
PTNX	Private Telecommunication Network Exchange
RN	Rerouting Number (information flow element)
SDL	Specification and Description Language
SS-CT	Supplementary Service Call Transfer
TE	Terminal Equipment
TIDR	Transfer Identity Result (information flow element)
TINR	Transfer Initiate Result (information flow element)
TIVR	Transfer Invoke Result (information flow element)

6 SS-CT stage 1 specification

6.1 Description

6.1.1 General description

SS-CT is a supplementary service which enables a served user (user A) to transform two of that user's calls into a new call between the other two users of the two calls (user B and user C). Each call can be either an incoming call to user A or an outgoing call from user A. After successful invocation of SS-CT user B and user C will be able to communicate with each other and user A will no longer be able to communicate with user B and user C.

One of the calls may be an outgoing call that has not been answered by the other user (user C). After successful invocation of SS-CT user A will no longer be able to communicate with user B. User B and user C will be in a position to communicate with each other as soon as user C has answered.

NOTE 1

The establishment of either call as part of a request for transfer is outside the scope of this ETS. This ETS assumes that both calls have already been established when the request for call transfer is made. This does not preclude an implementation whereby a single user request causes the establishment of a call and its subsequent transfer.

6.1.2 Qualifications on applicability to telecommunications services

SS-CT is applicable to all basic services defined in ETS 300 171.

6.2 Procedures

6.2.1 Provision/withdrawal

SS-CT shall be generally available. There is no need for service profile control.

6.2.2 Normal procedures

6.2.2.1 Activation/Deactivation/Registration/Interrogation

Not applicable.

6.2.2.2 Invocation and Operation

A Call Transfer request from a user (user A) shall be accepted only if it identifies two of that user's calls where:

- both calls (to/from user B and to/from user C) have been answered; or
- one call (to/from user B) has been answered and the other is an outgoing call which is alerting user C; or
- one call (to/from user B) has been answered and the other is an unanswered outgoing call to user C in a non-ISDN.

It shall not be necessary for user A to place either call on hold prior to invocation, although either or both calls may be held.

The network shall ensure that the transfer attempt does not allow an illegal connection to be made, for example one which would infringe CUG restrictions between user B and user C, or one which would result in a connection with incompatible bearer capabilities.

NOTE 2

It is user A's responsibility to ensure that the two calls are otherwise compatible.

Bearer capabilities shall not be considered compatible if they are the same. Bearer capabilities shall also be considered compatible if the only attribute that differs is information transfer capability and if one call has the value "speech" and the other call is interworking with a non-ISDN and has the value "3.1 kHz Audio".

NOTE 3

The provision of interworking functions between different bearer capabilities is outside the scope of this ETS.

The result of successful Call Transfer shall be a new call between users B and C, at which point the original connections to user A shall be released. Both users B and C shall be informed of the transfer and the name and number of the other user (if available and not subject to restriction), and whether the other user is still being alerted.

The network shall permit sub-addresses to be exchanged between user B and user C after transfer.

If user C is being alerted at the time of completion of transfer, it shall continue to be alerted, and on answer shall be connected to user B.

NOTE 4

If the call resulting from the invocation of Call Transfer before answer fails to progress to the answered state within a certain time other actions can be taken, e.g. user A can be recalled and on answer be connected to user B. The definition of procedures to support recall is outside the scope of this ETS.

6.2.3 Exceptional procedures

6.2.3.1 Activation/Deactivation/Registration/Interrogation

Not applicable.

6.2.3.2 Invocation and operation

Call Transfer shall be rejected under the following circumstances:

- if invalid call identities are specified;
- if neither of the calls is answered;
- if only one call is answered and the other is not an outgoing call which is either alerting a distant user or interworking with a non-ISDN;
- if the two calls have incompatible bearer capabilities;
- if interconnection of user B and user C is not permitted.

If transfer is rejected, user A shall be informed of the reason and the existing calls shall be unaffected.

6.3 Interactions with other supplementary services and ANFs

Interactions with other supplementary services and ANFs for which PTN standards were available at the time of publication of this ETS are specified below.

6.3.1 Calling Line Identification Presentation (SS-CLIP)

No interaction.

6.3.2 Connected Line Identification Presentation (SS-COLP)

No interaction.

6.3.3 Calling/Connected Line Identification Restriction (SS-CLIR)

User B's and C's restriction requirements from the original call shall be used to restrict the presentation of that user's number to the other user in a transferred call.

6.3.4 Calling Name Identification Presentation (SS-CNIP)

No interaction.

6.3.5 Connected Name Identification Presentation (SS-CONP)

No interaction.

6.3.6 Calling/Connected Name Identification Restriction (SS-CNIR)

User B's and C's restriction requirements from the original call shall be used to restrict the presentation of that user's name to the other user in a transferred call.

6.3.7 Call Forwarding Services

If Call Transfer occurs while user C is being alerted, the resulting call can subsequently undergo Call Forwarding on No Reply.

Call Transfer shall not affect the way in which chains of forwarding are controlled. Thus any hop counter value maintained in order to determine whether a forwarding may occur shall have the same value after transfer as it had prior to the transfer. The fact that a transfer has taken place shall not affect the way in which the counter value is subsequently modified due to forwarding.

6.3.8 Path Replacement (ANF-PR)

No interaction.

NOTE 5

Path Replacement may be invoked as a direct consequence of performing transfer if the transfer is achieved by joining as opposed to rerouting.

6.4 Interworking considerations

Call Transfer may take place when one or both of the calls involves interworking with a public ISDN or a public or private non-ISDN.

6.4.1 User B and/or User C in another network

Since the execution of the Call Transfer service need only involve the interconnection within the PTN of one end of each of two established connections, the nature of the network (ISDN or non-ISDN) containing user B or user C makes no difference to the operation of the service as seen by user A.

The PTN shall pass on any notifications associated with the transfer to the other network if the other network is capable of receiving this information, the possibilities being the notifications that transfer has taken place, whether the transfer has taken place prior to answer, the name and number (if appropriate) of the other user and the other user's subaddress and compatibility information.

NOTE 6

In the case where both user B and user C are in the same network, and that network supports a call transfer service across the access to it from a PTNX, a user A's PTNX which is acting as a gateway PTNX to the other network on both calls can attempt to invoke the service of the other network in order to effect a request for Call Transfer. Such procedures are outside the scope of this ETS.

6.4.2 User A in another network

The PTN shall accept transfer notifications from another network and pass them on to the PTN user. Transfer notifications include notifications that transfer has taken place, whether the transfer has taken place prior to answer, the name and number of the other user and the other user's subaddress and compatibility information. Where this information is not provided, a PTN user will have to rely on in-band information.

6.5 Overall SDL

Figure 1 contains the dynamic description of SS-CT using the Specification and Description Language (SDL) defined in CCITT Recommendation Z.100 (1988). The SDL process represents the behaviour of the network in providing SS-CT. The relationship of this process to the basic call process is indicated in the annotations.

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

Input signals from the right and output signals to the right represent primitives from and to users B and C.

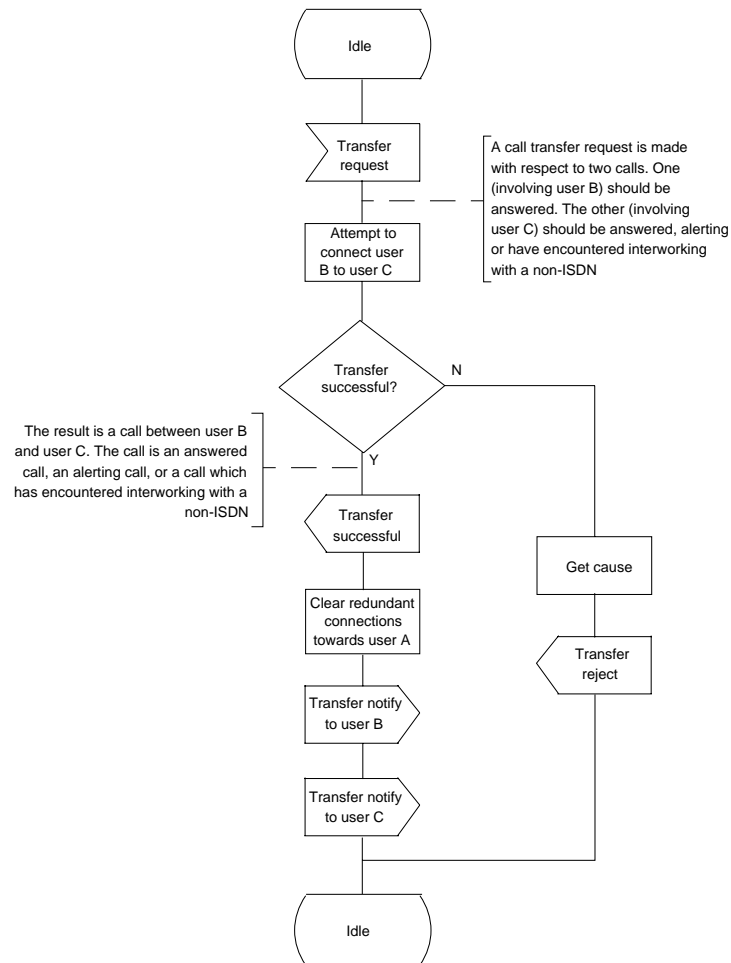


Figure 1 - SS-CT, Overall SDL

7 SS-CT stage 2 specification for transfer by join

7.1 Functional model

7.1.1 Functional model description

The functional model shall comprise the following Functional Entities:

- FE1 Transfer Invoke;
- FE2 Transfer Execute;
- FE3 Transfer Complete Receive;
- FE4 Transfer Notification Receive.

There shall be two instances of FE3 and FE4, one of each associated with user B and user C.

The following functional relationships shall exist between these FEs:

- rr between FE1 and FE2;
- rs between FE2 and FE3;
- rt between FE3 and the FE4 associated with the same user;
- ru between user B's FE4 and user C's FE4;
- rv between user B's FE3 and user C's FE3.

Figure 2 shows these FEs and relationships.

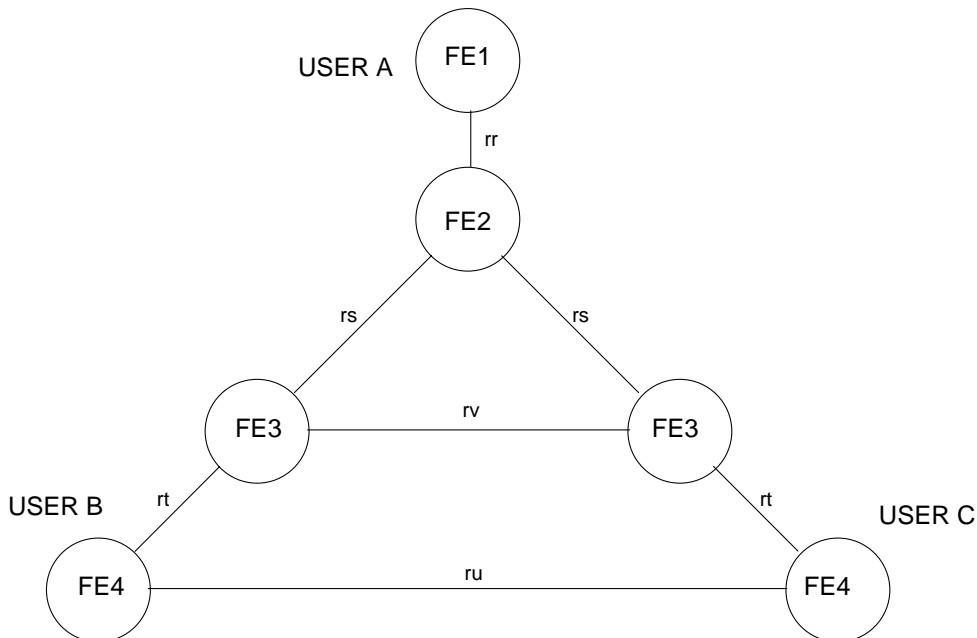


Figure 2 - Functional Model for SS-CT

7.1.2 Description of Functional Entities

7.1.2.1 Transfer Invoke Functional Entity, FE1

This FE acts on behalf of user A. It is responsible for recognising user A's decision to effect Call Transfer, and for identifying the two calls.

7.1.2.2 Transfer Execute Functional Entity, FE2

This FE checks that details known concerning the primary and secondary calls do not preclude the interconnection of user B and user C and creates the new connection between user B and user C by joining together the two existing connections.

7.1.2.3 Transfer Complete Receive Functional Entity, FE3

This FE acts on behalf of user B or user C, and notifies the respective FE4, that a transfer has occurred, along with the details of the new call. Two FE3s exist, one for user B and one for user C. This FE also passes to the other FE3 details about the associated user.

7.1.2.4 Transfer Notification Receive Functional Entity FE4

This FE receives on behalf of user B or user C the indication that a transfer has occurred, and the details of the new call. Two FE4s exist, one for user B and one for user C. This FE also passes to the other FE4 details relevant to the transfer which are not provided by the network.

7.1.3 Relationship of Functional Model to Basic Call Functional Model

Functional Entity FE1 shall be collocated with user A's CCAs for the two calls, except where user A's terminal is stimulus with respect to SS-CT but functional with respect to the basic call, in which case FE1 shall be collocated with user A's CCs for the two calls.

Functional Entity FE2 shall be collocated with user A's CCs for the two calls.

A functional Entity FE3 shall be collocated with each of user B's and user C's CCs.

A functional Entity FE4 shall be collocated with each of user B's and user C's CCAs, except where either or both of user B's and user C's terminals are stimulus with respect to SS-CT but functional with respect to the basic call, in which case the FE4 in question shall be collocated with the user's CC.

An example of a relationship between the FEs for SS-CT and FEs for the basic call is shown in Figure 3. In this example, user A is the called user of the primary call and the calling user of the secondary call.

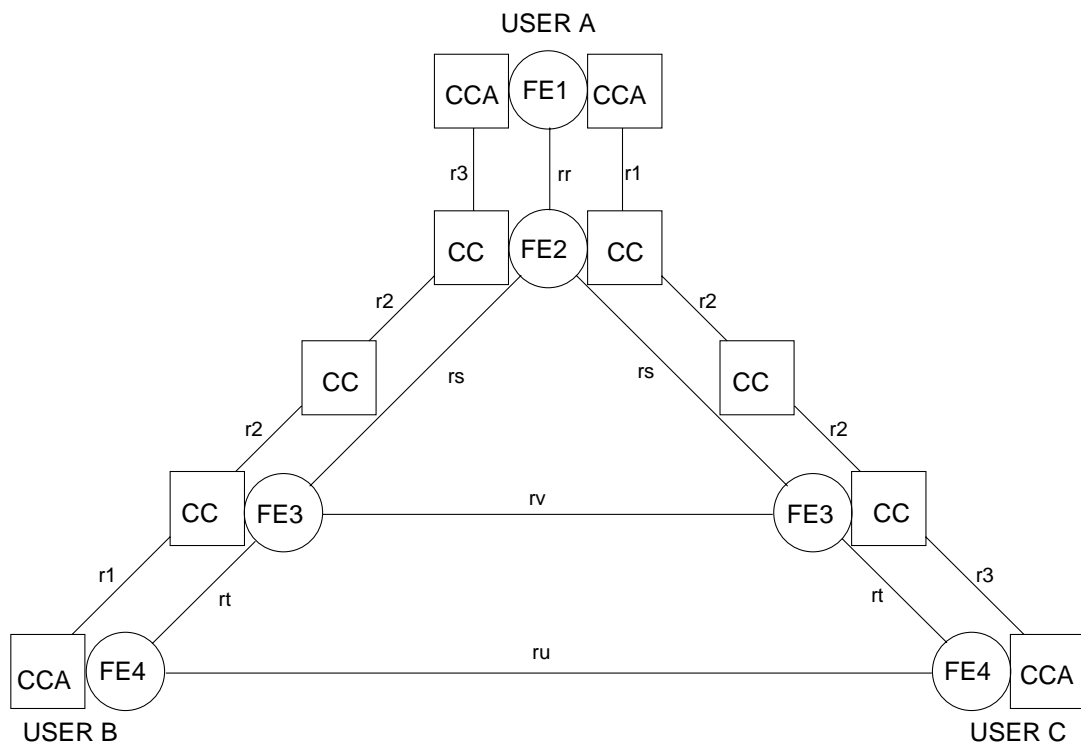


Figure 3 - Example Relationship between Model for SS-CT and Basic Call

7.2 Information flows

7.2.1 Definition of information flows

In the tables listing the elements in information flows, the column headed "Request" indicates which of these elements are mandatory (M) and which are optional (O) in a request/indication information flow, and the column headed "Confirm" indicates which of these elements are mandatory (M) and which are optional (O) in a response/confirmation information flow.

7.2.1.1 Transfer Invoke

This is a confirmed information flow across rr from FE1 to FE2 which initiates a transfer. The request contains the identities of the calls involving users B and C.

Table 1 lists the elements within the Transfer Invoke information flow.

Table 1 - Content of Transfer Invoke

Element	Request	Confirm
Call Identities (CI)	M	-
Transfer Invoke Result (TIVR)	-	M

Element CI shall contain the identities of the two calls to be transferred.

Element TIVR shall contain the result of the transfer invoke request and, if it indicates rejection, identify the reason for rejection. An indication of rejection means that the primary and secondary calls have not been affected by the invocation request. An indication of acceptance means that the transfer has been effected and that users B and C are now involved in the same call, without the involvement of user A.

7.2.1.2 Transfer Complete

This is an unconfirmed information flow across rs from FE2 to FE3 which indicates that a transfer has been effected.

Table 2 lists the elements within the Transfer Complete information flow.

Table 2 - Content of Transfer Complete

Element	Request
Connected Number (CN)	O (note)
Destination Category (DC)	O
Alerting Indication (AI)	O (note)
End Designation (ED)	M
Call History (CH)	O
Connected Name	O
<i>Note: CN and AI are mutually exclusive. AI may only be included in the case of an alerting transfer. CN may only be included in the case of an answered transfer.</i>	

Elements CN, DC and CH shall be as defined in ETS 300 171.

Element Connected Name shall comprise the elements of information flow INFORM 3 of ETS 300 237.

Element AI shall contain user C's number and restriction details if user C's number is known.

Element ED shall contain a designation for the new end PTNXs in the resultant call. Different designations of "Primary" and "Secondary" are given to the two new end PTNXs in order to allow them to be distinguished for the purpose of supporting services or features which may be invoked following Call Transfer.

7.2.1.3 Transfer Active

This is an unconfirmed flow across rs from FE2 to FE3 which indicates that answer has taken place following an alerting transfer.

Table 3 lists the elements within the Transfer Active information flow.

Table 3 - Content of Transfer Active

Element	Request
Connected Number (CN)	M
Connected Subaddress (CS)	O
Destination Category (DC)	O
Connected Name	O

Elements CN, CS and DC shall be as defined in ETS 300 171.

Element Connected Name shall comprise the elements of information flow INFORM 3 of ETS 300 237.

7.2.1.4 Transfer Notify

This is an unconfirmed flow across rt from FE3 to FE4 which informs users of the successful completion of a Call Transfer, and appropriate details of the other user. It can be repeated to provide further information about the transfer that has already been notified.

Table 4 lists the elements within the Transfer Notify information flow.

Table 4 - Content of Transfer Notify

Element	Request
Alerting Indication (AI)	O (note)
Connected Number (CN)	O (note)
Destination Category (DC)	O
Terminal Details Request	O
Call History (CH)	O
Connected Name	O
Connected Subaddress (CS)	O
<i>Note: CN and AI are mutually exclusive. AI is included in the case of an alerting transfer. CN is included (if appropriate) in the case of an answered transfer.</i>	

Element CN shall be as defined in ETS 300 173.

Element CS shall be as defined in ETS 300 173 and shall be included only when available from information flow transfer active.

Element AI shall include details of the other user involved in the transfer if known and not restricted, its contents being identical to those of element CN described in ETS 300 173.

Elements DC and CH shall be as defined in ETS 300 171.

Element Connected Name shall comprise the elements of information flow INFORM 4 of ETS 300 237.

Element Terminal Details Request shall be included if FE4 is to be invited to send the Terminal Details information flow.

7.2.1.5 Terminal Details

This is an unconfirmed information flow across ru from one FE4 to the other which allows the swapping of information between the users involved in the resultant call where such information is not necessarily stored by the network.

Table 5 lists the elements within the Terminal Details information flow.

Table 5 - Content of Terminal Details

Element	Request
Connected Subaddress (CS)	O

Element CS shall be as defined in ETS 300 173.

7.2.1.6 Transfer Update

This is an unconfirmed flow across rv which allows user B's and user C's FE3s to inform each other of all details about the transferred users that are known to the network.

Table 6 lists the elements within the Transfer Update information flow.

Table 6 - Content of Transfer Update

Element	Request
Connected Number (CN)	O (note)
Destination Category (DC)	O
Alerting Indication (AI)	O (note)
Connected Name	O
Call History (CH)	O
<i>Note: CN and AI are mutually exclusive. AI may only be included in the case of an alerting transfer. CN may only be included in the case of an answered transfer.</i>	

Elements CN, CH and DC shall be as defined in ETS 300 171.

Element AI shall contain user C's number and restriction details if user C's number is known.

Element Connected Name shall comprise the elements of information flow INFORM 3 of ETS 300 237.

7.2.2 Relationship of information flows to basic call information flows

None of the information flows of transfer by join are related to any basic call flows.

7.2.3 Examples of information flow sequences

A stage 3 standard for SS-CT shall provide signalling procedures in support of the information flow sequences specified below. In addition, signalling 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-CT 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 simultaneously. Within a column representing an SS-CT functional entity, the numbers refer to functional entity actions listed in 7.3.0

7.2.3.1 Successful Call Transfer (both calls answered)

Figure 4 shows the information flow sequence for normal operation of SS-CT when both calls have been answered.

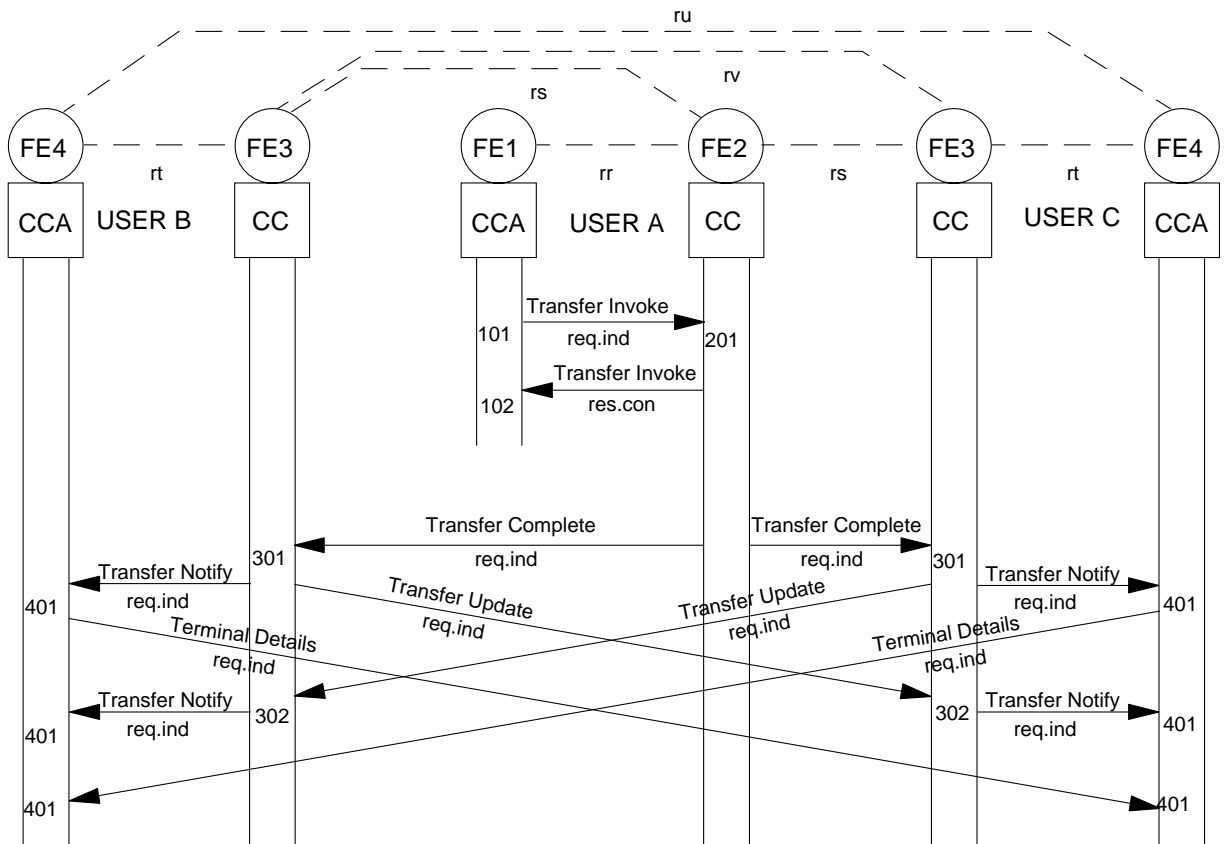


Figure 4 - Information Flow Sequence - Normal Operation of SS-CT (user C answered)

The Terminal Details flow is optional. If it occurs it may occur in either or both directions and is initiated on receipt of a Transfer Notify containing element Terminal Details Request.

7.2.3.2 Successful Call Transfer (user C alerting)

Figure 5 shows the information flow sequence for normal operation of SS-CT when user C is being alerted.

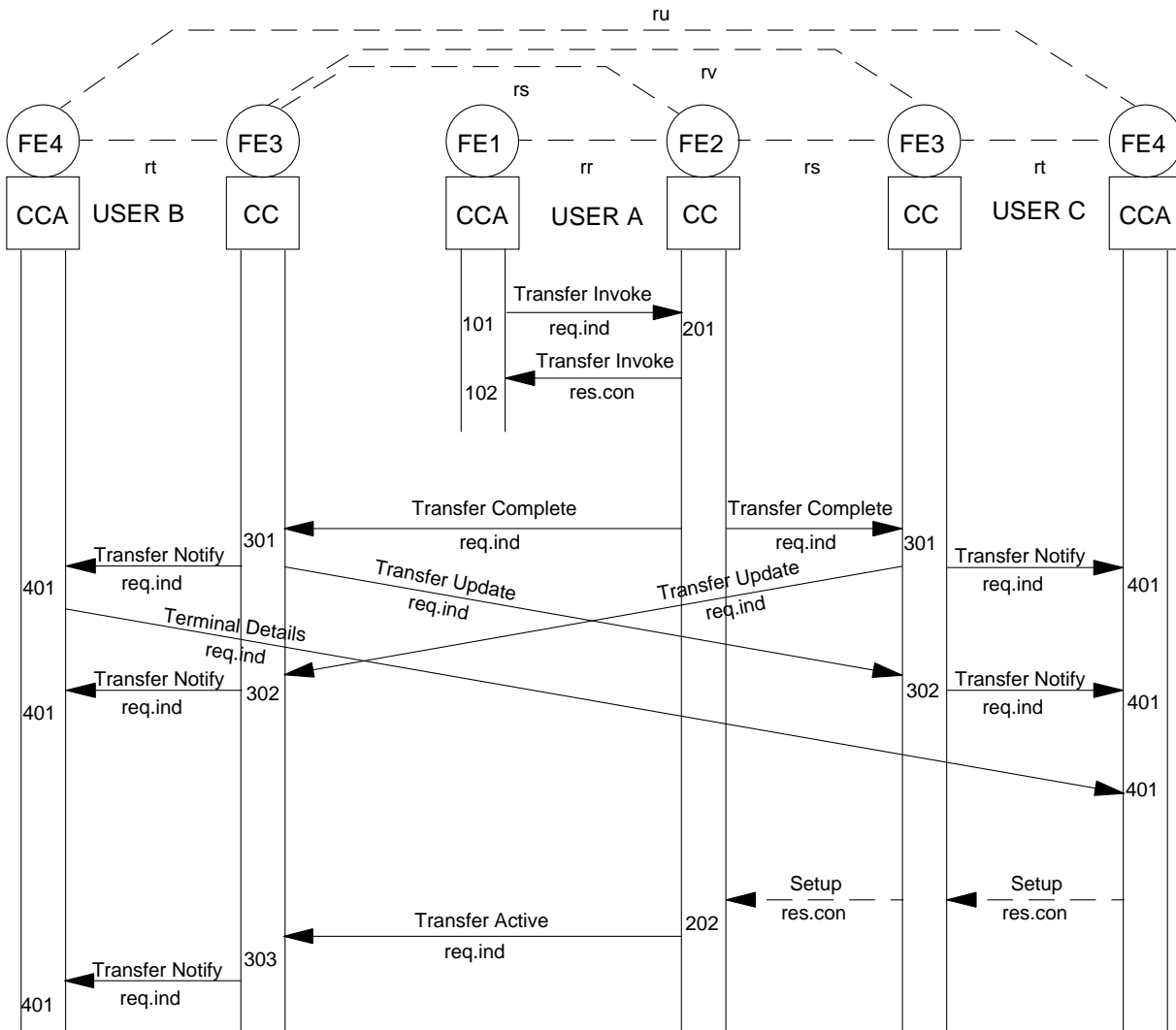


Figure 5 - Information Flow Sequence - Normal Operation of SS-CT (user C being alerted)

FE2 requests "transfer active" when the basic call Setup confirmation generated by user C answering is received by the basic call CC collocated with FE2.

The Terminal Details flow is optional. If it occurs it is initiated on receipt of Transfer Notify containing element Terminal Details Request.

7.3 Functional Entity actions

The following FE actions shall occur at the points indicated in the figures of 7.2.30.

7.3.1 Functional Entity actions of FE1

- 101 FE1 shall detect the user request for transfer. Local checks on the suitability of the transfer may be made and the request rejected on the basis of such checks. If the transfer is not barred locally, a Transfer Invoke request shall be sent to FE2.
- 102 On receipt of the Transfer Invoke confirmation, FE1 shall inform the user of the result, and in the case of successful completion, it may release the primary and secondary calls if they have not yet been released.

7.3.2 Functional Entity actions of FE2

201 On receipt of a Transfer Invoke indication from FE1, FE2 shall identify the primary and secondary calls and check the validity of the request from the network's point of view. The transfer shall be deemed invalid if the primary and secondary calls have incompatible bearer capabilities.

If the transfer is found to be invalid, a Transfer Invoke response shall be sent to FE1 indicating rejection.

If the transfer is deemed valid, a response indicating success shall be sent to FE1, the connections of the primary and secondary calls towards user B and user C shall be joined together and the connections of the primary and secondary calls towards user A shall be cleared. A Transfer Complete request shall be sent to each of the FE3s.

If user C was not being alerted at the time of transfer, the two local CCs shall be merged to form a new Transit CC for the new call.

202 If user C was being alerted at the time of transfer, a Transfer Active request shall be sent to user B's FE3 on detection of answer by user C (indicated by the receipt of a basic call Setup confirmation by the basic call CC collocated with FE2).

The two local CCs shall be merged to form a new Transit CC for the new call.

7.3.3 Functional Entity actions of FE3

301 On receipt of a Transfer Complete indication from FE2, a Transfer Notify request shall be sent to the associated FE4, a Transfer Update request shall be sent to the other FE3 and details relevant to the network concerning the new user in the call may be stored. The Transfer Notify shall contain element Terminal Details Request unless it is sent to a user C that has not answered. Any notifications appropriate due to other supplementary services may be sent to the new user in the call.

302 On receipt of a Transfer Update indication from the other FE3, a Transfer Notify request shall be sent to the associated FE4 and details relevant to the network concerning the other user in the call may be stored.

303 On receipt of a Transfer Active indication from FE2, relevant details may be stored and a second Transfer Notify request shall be sent to the associated FE4.

7.3.4 Functional Entity actions of FE4

401 On receipt of a Transfer Notify indication from the associated FE3 or a Terminal Details indication from the other FE4, relevant details may be stored. In the case of receipt of a Transfer Notify indication containing element Terminal Details Request, a Terminal Details request may be sent to the other FE4 if appropriate. In the case of an alerting transfer, the FE4 associated with user B can receive two of either indication.

7.4 Functional Entity behaviour

The FE behaviours shown below are intended to illustrate typical FE behaviour in terms of information flows sent and received.

The behaviour of each FE is shown using the Specification and Description Language (SDL) defined in CCITT Recommendation Z.100 (1988).

7.4.1 Behaviour of FE1

Figure 6 shows the normal behaviour of FE1. Input signals from the left and output signals to the left represent primitives from and to user A. Input signals from the right and output signals to the right represent information flows from and to FE2.

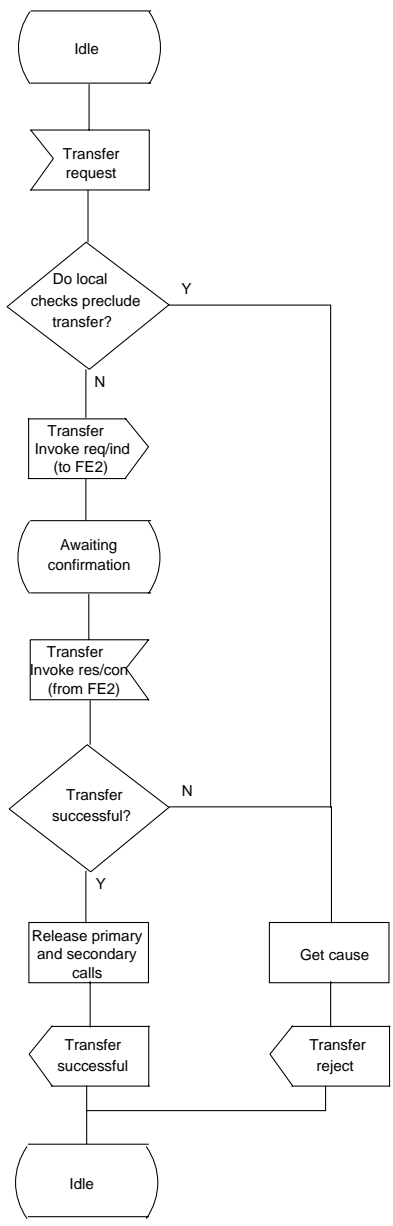


Figure 6 - SS-CT, SDL for Functional Entity FE1

7.4.2 Behaviour of FE2

Figure 7 shows the normal behaviour of FE2. Input signals from the left and output signals to the left represent information flows from and to FE1. Input signals from the right and output signals to the right represent information flows from and to FE3 and basic call CCs collocated with FE2.

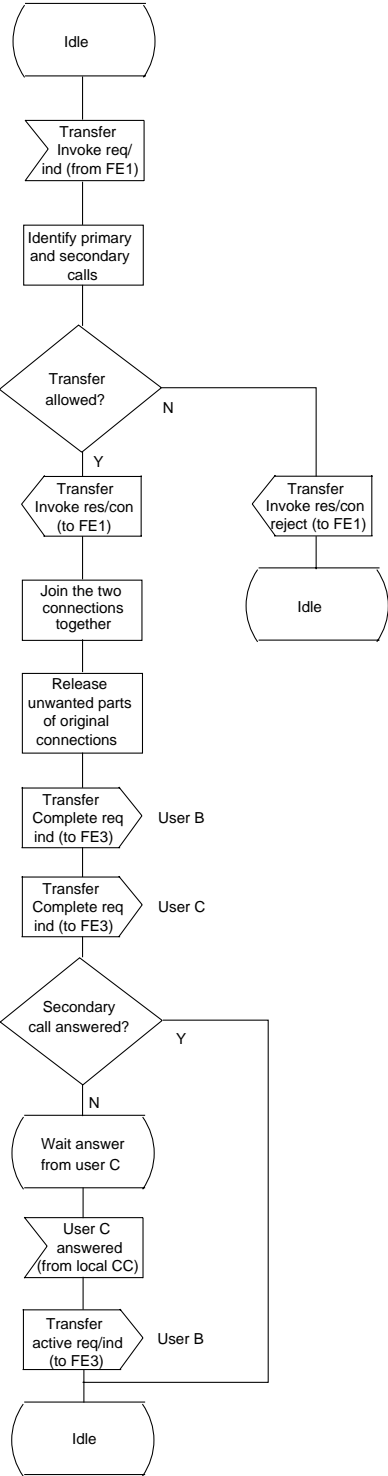


Figure 7 - SS-CT, SDL for Functional Entity FE2

7.4.3 Behaviour of FE3

Figure 8 shows the normal behaviour of FE3. Input signals from the left and output signals to the left represent information flows from and to FE2 and the other FE3. Input signals from the right and output signals to the right represent information flows from and to FE4.

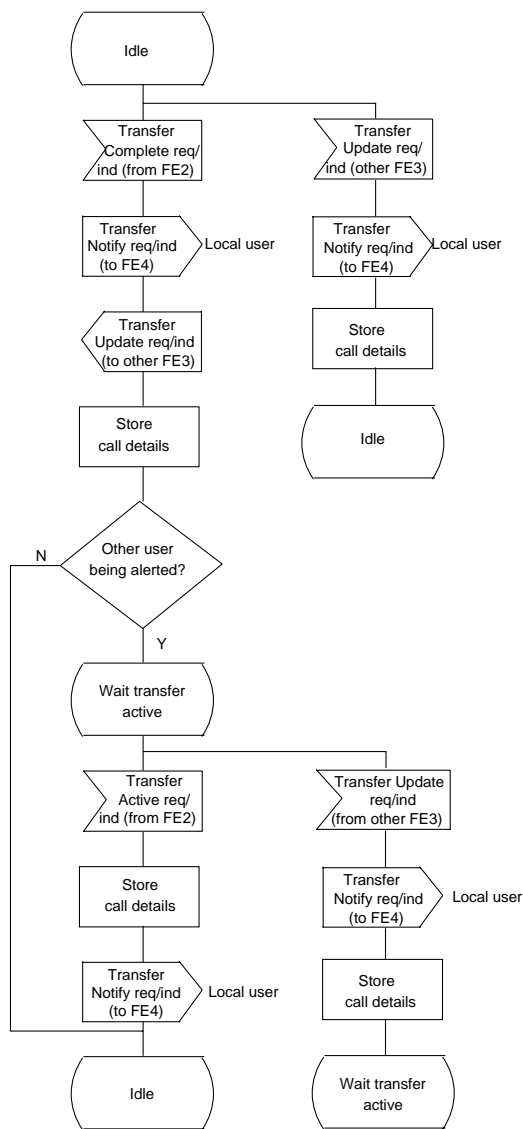


Figure 8 - SS-CT, SDL for Functional Entity FE3

7.4.4 Behaviour of FE4

Figure 9 shows the normal behaviour of FE4. Input signals from the left and output signals to the left represent primitives from and to user B or user C. Input signals from the right and output signals to the right represent information flows from and to FE3 and the other FE4.

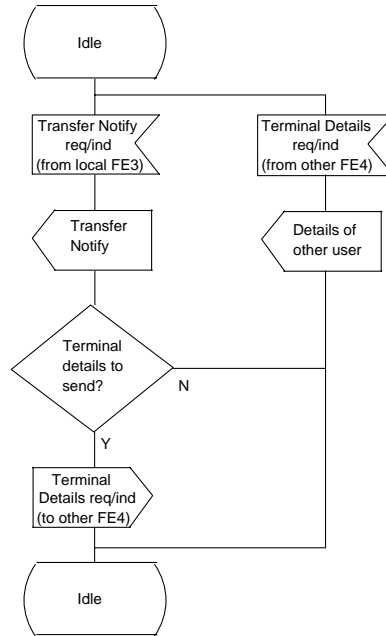


Figure 9 - SS-CT, SDL for Functional Entity FE4

7.5 Allocation of Functional Entities to Physical Locations

The allocations of FEs to physical equipment shown in table 76 shall apply. In the table, "TE" represents a TE attached to a PTN. Where a terminal involved is stimulus with respect to SS-CT, any FE shown as residing in the TE shall reside instead in that TE's local PTNX.

Table 7 - FE location scenarios

Scenarios		Functional Entities					
		User A		User B		User C	
		FE1	FE2	FE3	FE4	FE3	FE4
1	Intra-PTN transfer	TE	PTNX	PTNX	TE	PTNX	TE
2	User A in PTN, users B, C in other network	TE	PTNX	gateway PTNX	other network	gateway PTNX	other network
3	Users A, B in PTN, user C in other network	TE	PTNX	PTNX	TE	gateway PTNX	other network
4	Users A, C in PTN, user B in other network	TE	PTNX	gateway PTNX	other network	PTNX	TE
5	User A in other network, users B and C in PTN	other network	other network	other network	TE	other network	TE
6	Users A, B in other network, user C in PTN	other network	other network	other network	other network	other network	TE
7	Users A, C in other network, user B in PTN	other network	other network	other network	TE	other network	other network
8	All users in other network	other network	other network	other network	other network	other network	other network

7.6 Interworking considerations

In the case where user B or user C is in another network, information pertaining to relationship rt is passed across the access to the other network by the gateway PTNX if the other network is able to accept and convey all or part of such information.

In the case where user A is in another network, any information pertaining to relationship rt received by the gateway PTNX or by the user's PTNX may be used by that PTNX.

8 SS-CT stage 2 specification for transfer by rerouting

A stage 3 standard for SS-CT shall be capable of supporting the functional breakdown of the service specified in this clause.

8.1 Functional model

8.1.1 Functional model description

The functional model shall comprise the following Functional Entities:

- FE1 Transfer Invoke;
- FE4 Transfer Notification Receive;
- FE5 Transfer Co-ordinate;
- FE6 Transfer Associate;
- FE7 Transfer Execute.

There shall be two instances of FE4, one associated with user B and one associated with user C.

The following functional relationships shall exist between these FEs:

- rr between FE1 and FE5;
- rt between FE6 and user C's FE4 and between FE7 and user B's FE4;
- ru between user B's FE4 and user C's FE4;
- rx between FE5 and FE6;
- ry between FE5 and FE7;
- rz between FE6 and FE7.

Figure 10 shows these FEs and relationships.

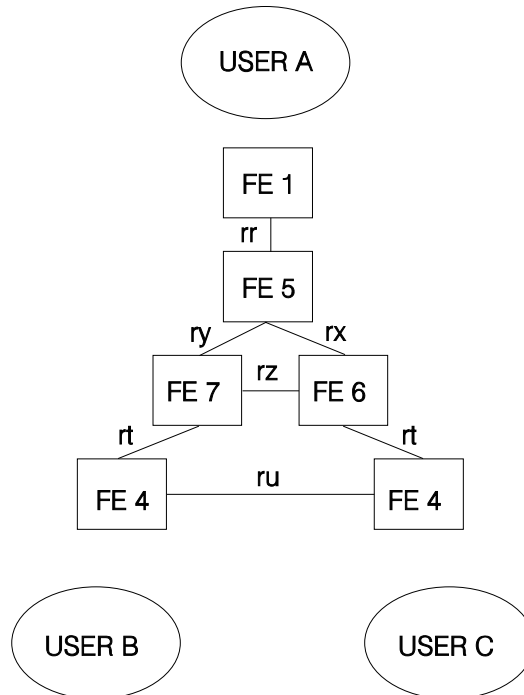


Figure 10 - Functional Model of SS-CT

8.1.2 Description of Functional Entities

8.1.2.1 Transfer Invoke Functional Entity, FE1

7.1.2.1 applies.

8.1.2.2 Transfer Notification Receive Functional Entity, FE4

7.1.2.4 applies.

8.1.2.3 Transfer Co-ordinate Functional Entity, FE5

This FE checks that details known concerning the primary and secondary calls do not preclude the interconnection of user B and user C, and co-ordinates the activities of FE6 and FE7 in executing the transfer.

8.1.2.4 Transfer Associate Functional Entity, FE6

This FE associates the new connection between user B and user C with the existing connection between user A and user C. On successful completion of the transfer, it releases the part of the existing connection between user A and user C which is no longer required and notifies to user C's FE4 the fact that the transfer has occurred.

8.1.2.5 Transfer Execute Functional Entity, FE7

This FE initiates the establishment of the new connection between user B and user C. On successful completion of the transfer, it releases the part of the existing connection between user A and user B which is no longer required and notifies to user B's FE4 the fact that the transfer has occurred.

8.1.3 Relationship of Functional Model to Basic Call Functional Model

Functional Entity FE1 shall be collocated with user A's CCAs for the two calls, except where user A's terminal is stimulus with respect to Transfer but functional with respect to the basic call, in which case FE1 shall be collocated with user A's CCAs for the two calls.

Functional Entity FE5 shall be collocated with user A's CCAs for the two calls.

Functional Entity FE6 shall be collocated with user C's CC.

Functional Entity FE7 shall be collocated with user B's CC.

A Functional Entity FE4 shall be collocated with each of user B's and user C's CCAs, except where either or both of user B's and user C's terminals are stimulus with respect to Transfer but functional with respect to the basic call, in which case the FE4 in question shall be collocated with the user's CC.

An example of a relationship between the FEs for SS-CT and FEs for the basic call is shown in figure 11. In this example, user A is the called user of the primary call and the calling user of the secondary call.

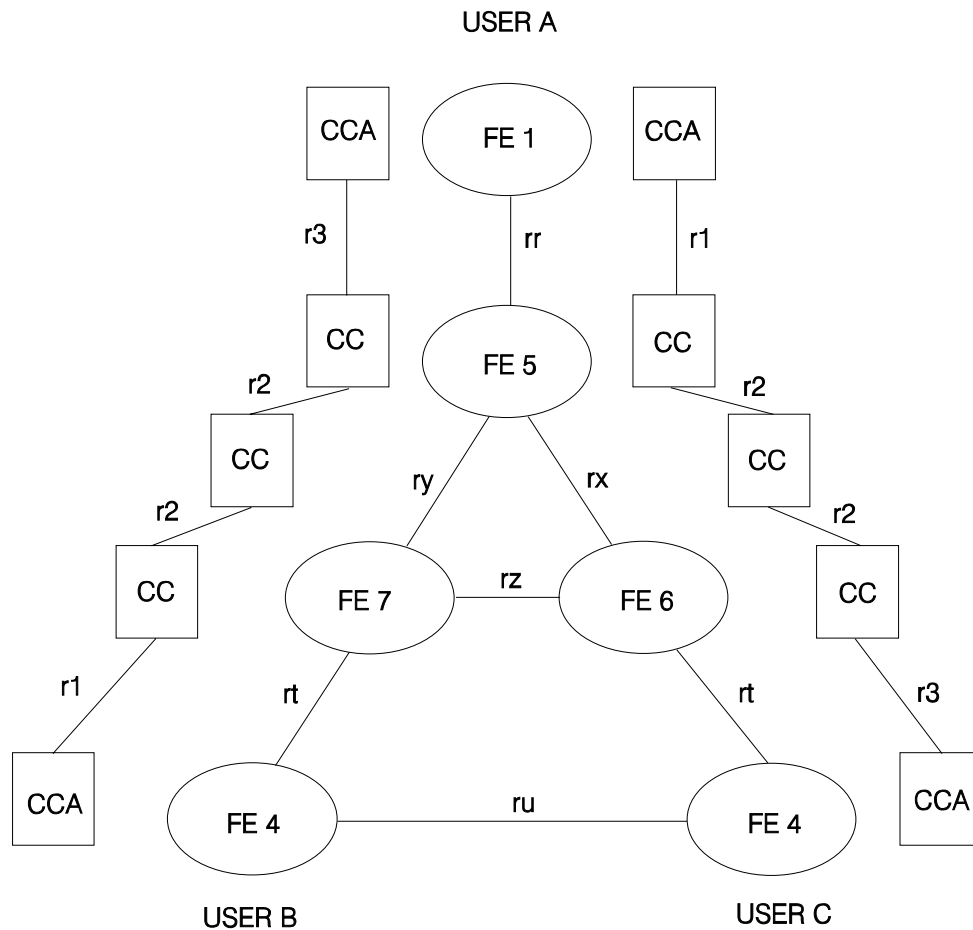


Figure 11 - Example Relationship between Model for SS-CT and Basic Call

8.2 Information flows

8.2.1 Definition of information flows

The following information flows shall be supported.

8.2.1.1 Transfer Invoke

7.2.1.1 applies.

8.2.1.2 Transfer Identify

8.2.1.2.1 Meaning of Transfer Identify

This confirmed information flow determines the ability of the FE6 to participate in the transfer and if so provides an identity for the secondary call which can be used in the setup process.

8.2.1.2.2 Information content of Transfer Identify

Table 8 lists the service elements within the Transfer Identify information flow. The column headed "Request" indicates which of these service elements are mandatory (M) and which are optional (O) in a Transfer Identify request/indication information flow. The column headed "Confirm" indicates which of these service elements are mandatory (M) and which are optional (O) in a Transfer Identify response/confirmation information flow.

Table 8 - Content of Transfer Identify

Service Element	Request	Confirm
Call Identity (CID)	-	O (note)
Rerouting Number (RN)	-	O (note)
Transfer Identity Result (TIDR)	-	M
<i>Note: Mandatory if request accepted.</i>		

Service element CID shall contain a call identity which has significance at FE6 and which is used by FE6 to associate the new connection, when it arrives at FE6, with the secondary call.

Service element RN shall contain a number which will enable the new connection to be routed to FE6.

Service element TIDR shall contain the result of the transfer identify request, and if it indicates rejection, then it shall identify the reason for rejection. Rejection may occur if rerouting is not supported. An indication of acceptance means that the addressed FE6 is able to participate in the transfer and that it is awaiting completion.

8.2.1.3 Transfer Abandon

8.2.1.3.1 Meaning of Transfer Abandon

This unconfirmed information flow indicates that the transfer by rerouting is to be aborted.

8.2.1.3.2 Information content of Transfer Abandon

None.

8.2.1.4 Transfer Initiate

8.2.1.4.1 Meaning of Transfer Initiate

This confirmed information flow determines the ability of the FE7 to participate in the transfer and, if so, to set up a call using the information which was provided to FE5 by FE6 in the Transfer Identify Response.

8.2.1.4.2 Information content of Transfer Initiate

Table 9 lists the service elements within the Transfer Initiate information flow. The column headed "Request" indicates which of these service elements are mandatory (M) and which are optional (O) in a Transfer Initiate request/indication information flow. The column headed "Confirm" indicates which of these service elements are mandatory (M) and which are optional (O) in a Transfer Initiate response/confirmation information flow.

Table 9 - Content of Transfer Initiate

Service Element	Request	Confirm
Call Identity (CID)	M	-
Rerouting Number (RN)	M	-
Transfer Initiate Result (TINR)	-	M

Service elements CID and RN shall be as defined for the "Transfer Identify" information flow across relationship rx.

Service element TINR shall contain the result of the transfer initiate request, and if it indicates rejection, then it shall identify the reason for rejection. Rejection may occur if rerouting is not supported at FE7 or if the new connection cannot be established, e.g. because of congestion.

8.2.1.5 Transfer Setup

8.2.1.5.1 Meaning of Transfer Setup

This confirmed flow is associated with a "basic call" Setup Information flow for the transferred call using the Rerouting Number (RN) supplied originally by FE6 as the Called Number. In addition it contains the Call Identity (CID) of the secondary call, as originally supplied by FE6, which is used to associate the new call with the secondary call at FE6. If the transfer is an alerting transfer then the response is not associated with the corresponding basic call setup response but with the basic call (Alerting) report.

8.2.1.5.2 Information content of Transfer Setup

Table 10 lists the service elements within the Transfer Setup information flow. The column headed "Request" indicates which of these service elements are mandatory (M) and which are optional (O) in a Transfer Setup request/indication information flow. The column headed "Confirm" indicates which of these service elements are mandatory (M) and which are optional (O) in a Transfer Setup response/confirmation information flow.

Table 10 - Content of Transfer Setup

Service Element	Request	Confirm
Call Identity (CID)	M	-
Alerting Indication (AI)	-	O (note)
Connected Number (CN)	O	O (note)
Destination Category (DC)	O	O
Connected Name	O	O
Call History (CH)	O	O
<i>Note: CN and AI are mutually exclusive. AI may only be included in the case of an alerting transfer. CN may only be included in the case of an answered transfer.</i>		

Service element CID shall be as defined for the "Transfer Identify" information flow across relationship rx.

Elements CN, CH and DC shall be as defined in ETS 300 171.

Element AI shall contain user C's number and restriction details if user's C number is known.

Element Connected Name shall comprise the elements of information flow INFORM 3 of ETS 300 237.

8.2.1.6 Transfer Notify

7.2.1.4 shall apply.

8.2.1.7 Terminal Details

7.2.1.5 shall apply.

8.2.2 Relationship of information flows to basic call information flows

None of the information flows of transfer by rerouting are related to any basic call flows.

8.2.3 Examples of information flow sequences

Below are examples of typical sequences of information flows. In addition to providing signalling procedures in support of these sequences, a stage 3 standard shall also cover other sequences arising from error situations, interactions with basic call, interactions with other supplementary services, different topologies, etc.

In the figures, SS-CT 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 simultaneously. Within a column representing an SS-CT functional entity, the numbers refer to functional entity actions listed in 8.3.

8.2.3.1 Successful Call Transfer (answered)

Figure 12 shows the information flow sequence for normal operation of SS-CT when user C has answered.

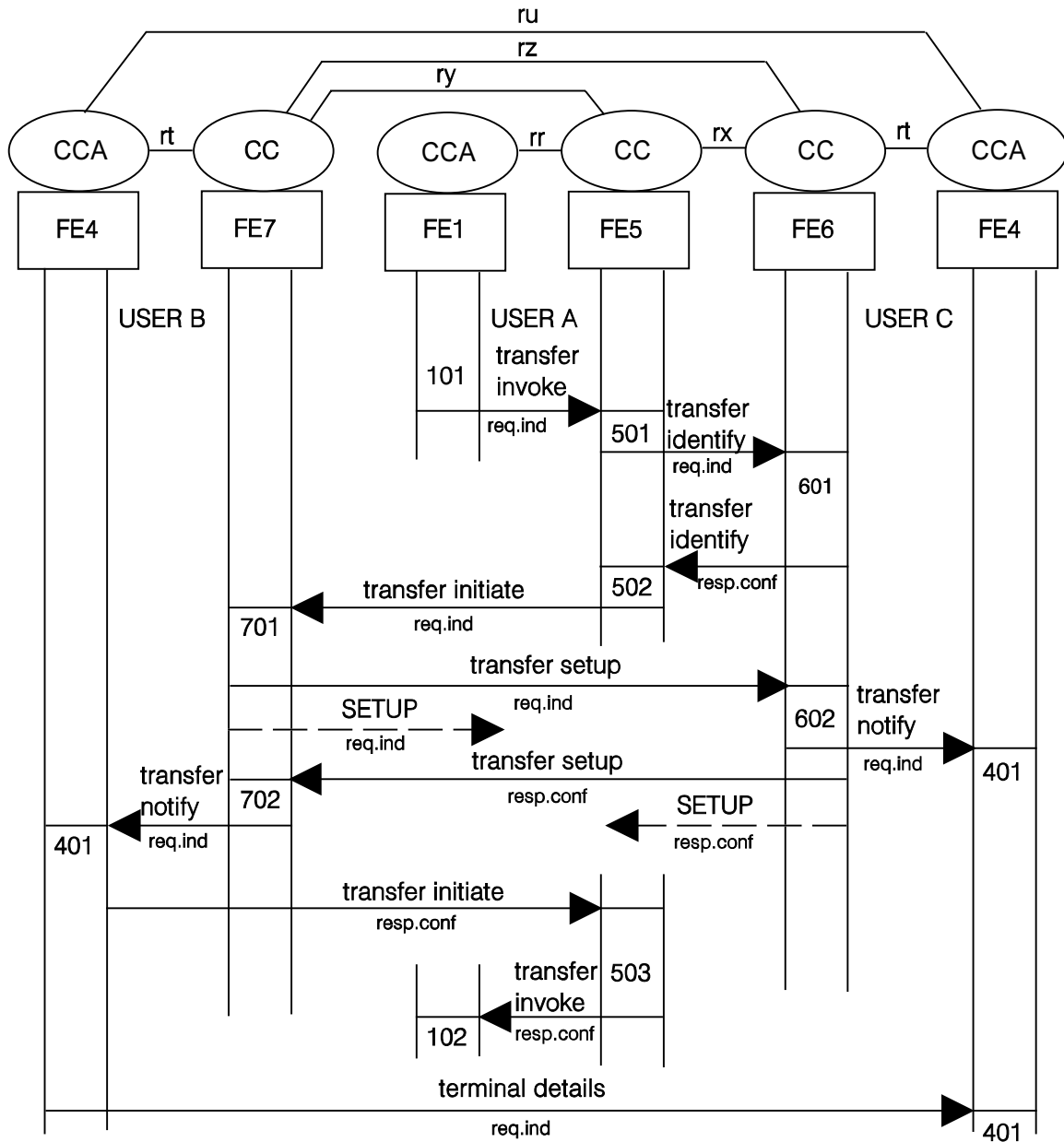


Figure 12 - Information Flow Sequence - Normal Operation of SS-CT (user C answered)

The Terminal Details flow is optional. If it occurs it may occur in either or both directions and is initiated on receipt of a Transfer Notify containing element Terminal Details Request.

8.2.3.2 Successful Call Transfer (alerting)

Figure 13 shows the information flow sequence for normal operation of SS-CT when user C is being alerted.

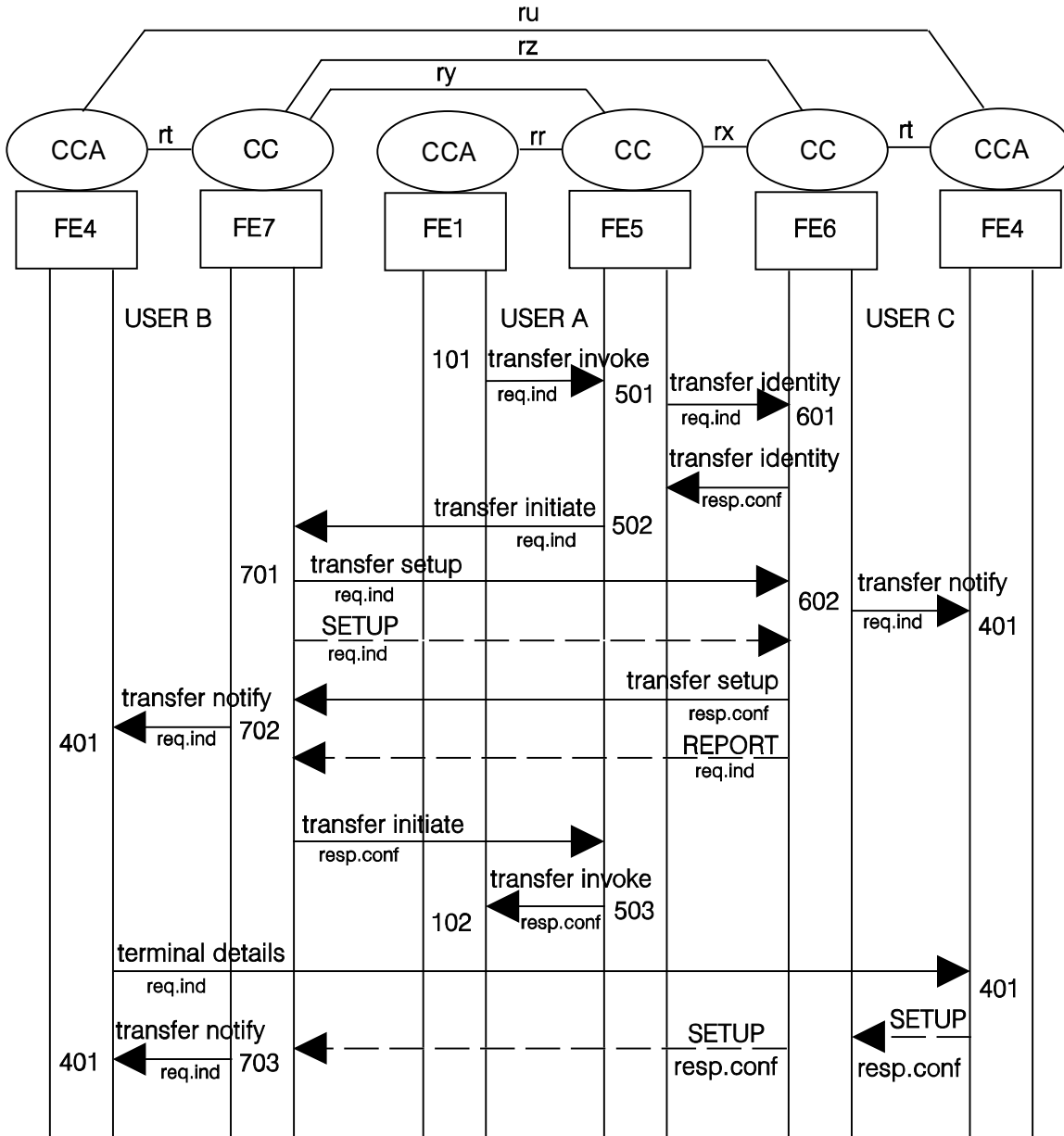


Figure 13 - Information Flow Sequence - Normal Operation of SS-CT (user C alerting)

The Terminal Details flow is optional. If it occurs it is initiated on receipt of a Transfer Notify containing element Terminal Details Request.

8.2.3.3 Unsuccessful Call Transfer (setup fails)

Figure 14 shows the information flow sequence for unsuccessful operation of SS-CT when basic call does not reach user C's PTNX owing to congestion.

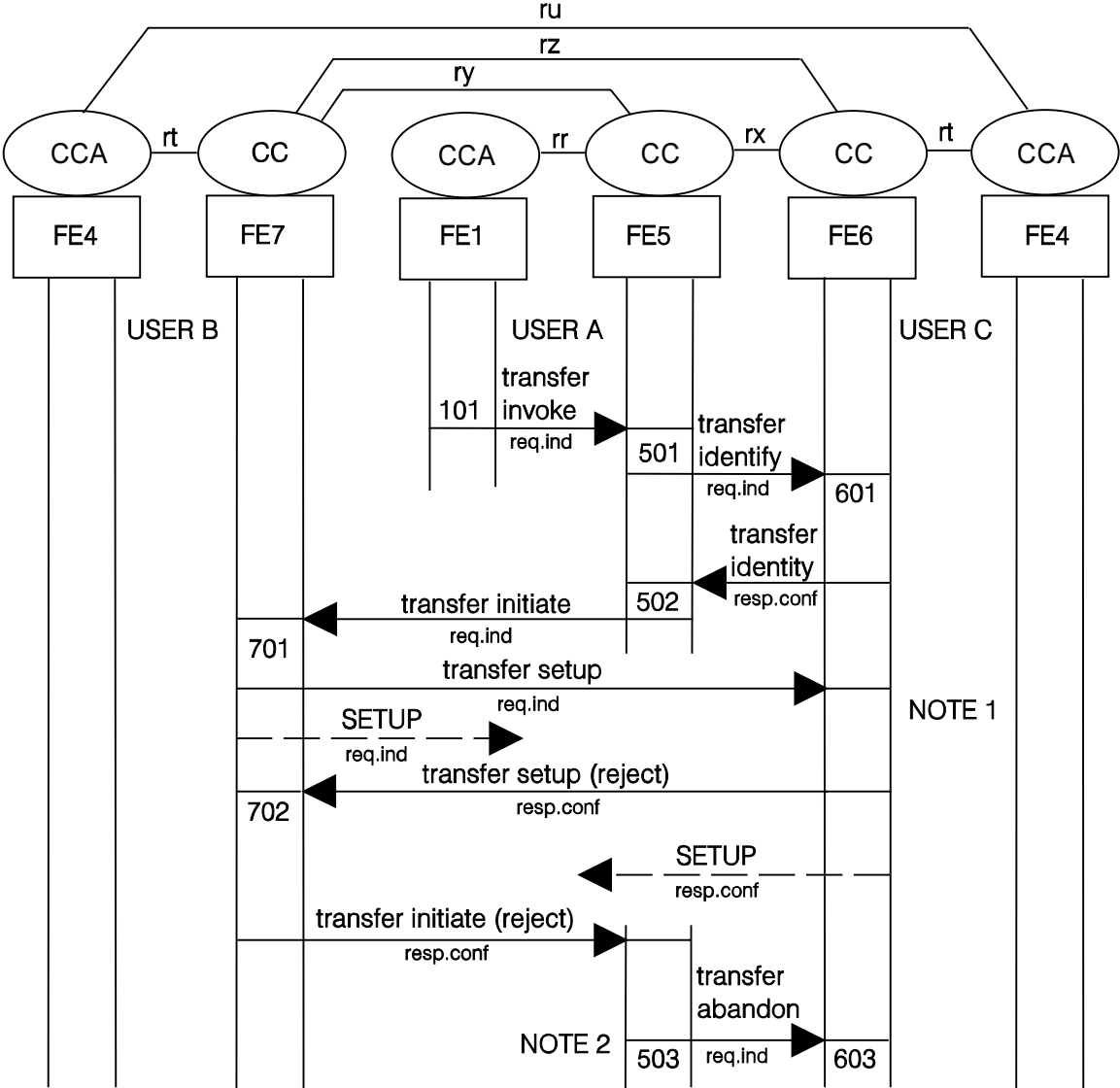


Figure 14 - Information Flow Sequence - Unsuccessful Operation of SS-CT (call setup fails)

8.3 Functional Entity actions

8.3.1 Functional Entity actions of FE1

7.3.1 shall apply.

8.3.2 Functional Entity actions of FE5

501 On receipt of a Transfer Invoke indication from FE1, FE5 identifies the primary and secondary calls and checks the validity of the requests from the network's point of view. The transfer shall be deemed invalid if the primary and secondary calls have incompatible bearer capabilities.

If the transfer is found to be invalid, a Transfer Invoke response is sent to FE1 indicating rejection.

If the transfer is deemed valid, a transfer identify request is sent to FE6.

502 On receipt of the Transfer Identify confirmation from FE6, a Transfer Initiate request is sent to FE7 if FE6 is able to co-operate. If FE6 is unable to proceed then a fall-back to transfer by join occurs; this is effected by FE2 processing the original request received by FE5 from FE1.

503 On receipt of the Transfer Initiate confirmation from FE7, a Transfer Invoke response is sent to FE1 if FE7 indicates successful completion of the transfer. If FE7 has been unable to complete the transfer, a Transfer Abandon request is sent to FE6 and a fallback to transfer by join occurs; this is effected by FE2 processing the original request received by FE5 from FE1.

8.3.3 Functional Entity actions of FE6

601 On receipt of a Transfer Identify indication from FE5, FE6 determines whether or not it can participate in the transfer. If FE6 is not able to participate in the transfer, a response indicating rejection is returned to FE5. Otherwise FE6 allocates a locally significant call identity which is included together with a rerouting number in the response to FE5 and the setup of the new connection is awaited.

602 On receipt of the Transfer Setup indication from FE7, the new connection is joined to the part of the secondary call toward user C, the part of the secondary call toward user A is released, a response to the Transfer Setup is returned to FE7, and a Transfer Notify request is sent to the FE4 associated with user C. The Transfer Notify shall contain element Terminal Details Request unless it is sent to a user C that has not answered.

603 If Transfer Abandon is received form FE5 instead of the receipt of an acceptable Transfer Setup from FE7, resources such as the call identity are released and FE6 takes no further part in the transfer.

8.3.4 Functional Entity actions of FE7

701 On receipt of a Transfer Initiate indication from FE5, FE7 determines whether or not it can participate in the transfer. If FE7 is not able to participate in the transfer, a response indicating rejection is returned to FE5. Otherwise a Transfer Setup request is sent to FE6 associated with a basic call request.

- 702 On receipt of the Transfer Setup confirmation indicating success from FE6, the new connection is joined to the part of the primary call toward user B, a response indicating successful completion is sent to FE5, the part of the primary call toward user A is released, and a Transfer Notify request is sent to the FE4 associated with user B. The Transfer Notify Request shall contain element Terminal Details Request. If instead the Transfer Setup is rejected by FE6 or the basic call associated with the Transfer Setup request fails, the Transfer Initiate indication is rejected and FE7 takes no further part in the transfer.
- 703 If user C was being alerted at the time of transfer, a basic call setup confirmation is awaited from the CC collocated with FE7. On receipt, a Transfer Notify request is passed to the FE4 associated with user B.

8.3.5 Functional Entity actions of FE4

7.3.4 shall apply.

8.4 Functional Entity behaviour

The FE behaviours shown below are intended to illustrate typical FE behaviour in terms of information flows sent and received.

The behaviour of each FE is shown using the Specification and Description Language (SDL) defined in CCITT Recommendation Z.100 (1988).

The SDL for FE1 is as described by figure 6, except that references to FE2 are replaced by references to FE5.

The SDL for FE4 is as described by figure 9, except that references to FE3 are replaced by references to FE6 and FE7.

8.4.1 Behaviour of FE5

Figure 15 shows the normal behaviour of FE5. Input signals from the left and output signals to the left represent information flows from and to FE1. Input signals from the right and output signals to the right represent information flows from and to FE6.

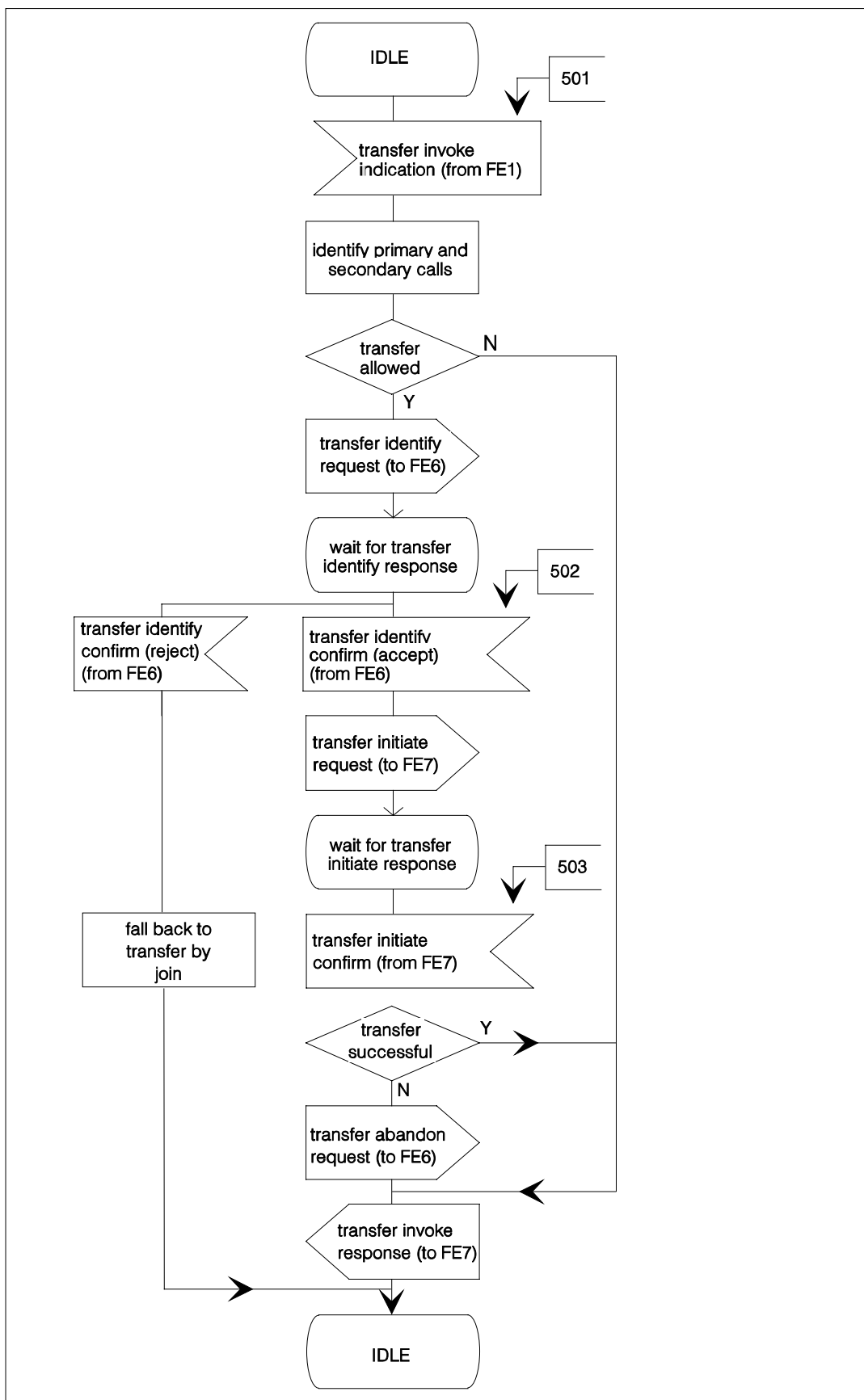


Figure 15 - SS-CT, SDL for Functional Entity FE5

8.4.2 Behaviour of FE6

Figure 16 shows the normal behaviour of FE6. Input signals from the left and output signals to the left represent information flows from and to FE5. Input signals from the right and output signals to the right represent information flows from and to FE4.

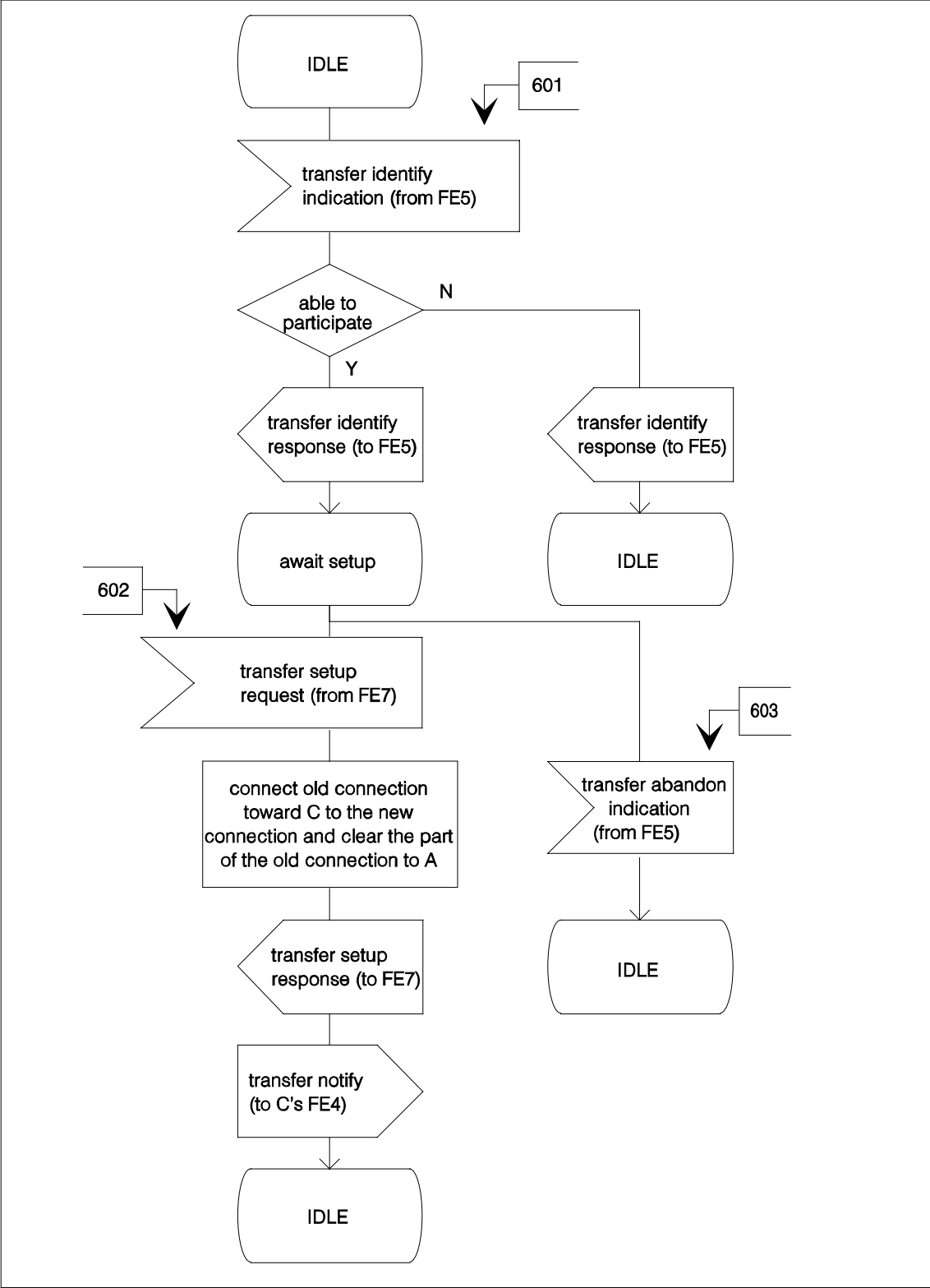


Figure 16 - SS-CT, SDL for Functional Entity FE6

8.4.3 Behaviour of FE7

Figure 17 shows the normal behaviour of FE7. Input signals from the left and output signals to the left represent information flows from and to FE4. Input signals from the right and output signals to the right represent information flows from and to FE5, FE6 and basic call CCs collocated with FE7

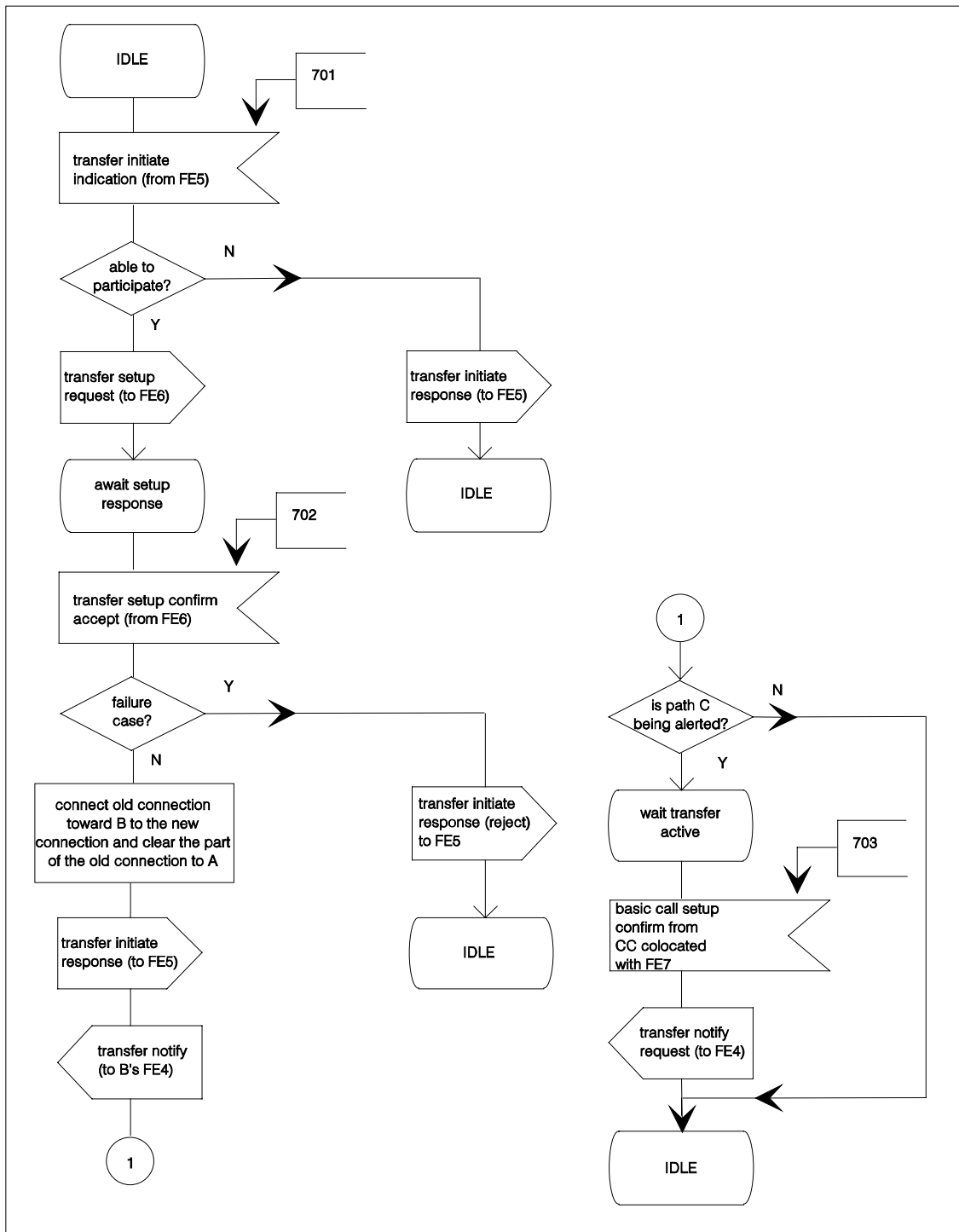


Figure 17 - SS-CT, SDL for Functional Entity FE7

Annex A (informative): Relationship to corresponding ETSs for Public ISDNs

SS-CT for PTNs specified in this ETS complements and is compatible with the Explicit Call Transfer supplementary service for public ISDNs as specified in draft prETS 300 367 and draft prETS 300 368 for stages 1 and 2 respectively. There are no differences which will prevent terminal interchangeability between PTNs and public ISDNs. However, there are significant differences in PTN internal operation when the rerouting option is used. There are also differences in the style and layout of this ETS in comparison with the corresponding ETSs for the public ISDN. The main differences can be summarised as follows:

1. PTN terminology is used, where appropriate, instead of public ISDN terminology.
2. Stages 1 and 2 are specified together in this ETS, rather than as separate Standards.
3. The specification of the stage 1 aspects in this ETS is in terms of primitives transferred across service access points to/from the user. Public ISDN stage 1 specifications are in terms of the visibility of the service at the S/T and T reference points.
4. In the stage 1 specification in this ETS, interactions with other supplementary services are specified only for those other supplementary services for which PTN standards were available at the time of publication of this ETS.
5. In the stage 1 specification for public ISDNs, it is stated that one of the two calls involved must be held prior to invocation of Call Transfer. In a PTN this is not necessary.
6. Transfer by rerouting is not specified in the stage 2 for public ISDNs.
7. The stage 2 specification for public ISDNs contains an additional FE. Effectively there are two public ISDN FEs (FE2 and FE3) which in combination provide the functionality of PTN FE2, the intention being that this could accommodate (in the future) invocation of Call Transfer in a public ISDN on behalf of a private ISDN.
8. In the stage 2 specification for public ISDNs, the Terminal Details information flow is routed via an FE in the local exchange (for policing purposes), rather than directly from terminal to terminal.
9. There is no equivalent in the stage 2 specification for public ISDNs of relationship rv and its Transfer Update information flow.
10. Some information flows specified in this ETS contain additional elements that are not present in the corresponding information flows for public ISDNs, e.g. party category.

Annex B (informative): Bibliography

- Draft prETS 300 367 Integrated Services Digital Network (ISDN);
Explicit Call Transfer (ECT) supplementary service
Service description
- Draft prETS 300 368 Integrated Services Digital Network (ISDN);
Explicit Call Transfer (ECT) supplementary service
Functional capabilities and information flows

History

Document history	
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