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Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Specification, functional model and information flows — Call Transfer supplementary service

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Réseau privé à intégration de services — Spécification, modèle fonctionnel et flux d'informations — Service supplémentaire de transfert d'appel

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 13865 was prepared by ECMA (as ECMA-177) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This second edition cancels and replaces the first edition (ISO/IEC 13865:1995), which has been technically revised.

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Introduction

This International Standard is one of a series of Standards defining services and signalling protocols applicable to Private Integrated Services Networks (PISNs). The series uses ISDN concepts as developed by ITU-T and conforms to the framework of International Standards for Open Systems Interconnection as defined by ISO/IEC.

This International Standard specifies the Call Transfer supplementary service.

This International Standard is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO/IEC JTC 1, ITU-T, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

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Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Specification, functional model and information flows — Call Transfer supplementary service

1 Scope

This International Standard specifies Supplementary Service Call Transfer (SS-CT), which is applicable to various basic services supported by Private Integrated Services Networks (PISNs). Basic services are specified in ISO/IEC 11574.

SS-CT is a supplementary service which enables a user to transform two of that user's calls (of which one must be answered) into a new call between the other two users of the two calls.

Supplementary service specifications are produced in three stages, according to the method described in ETS 300 387. This International Standard contains the stage 1 and stage 2 specifications of SS-CT. The stage 1 specification (clause 6) specifies the supplementary service as seen by users of PISNs. The stage 2 specification (clauses 7 and 8) identifies the functional entities involved in the supplementary service and the information flows between them.

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

2 Conformance

In order to conform to this International Standard, a stage 3 standard shall specify signalling protocols and equipment behaviour that are capable of being used in a PISN which supports the supplementary services specified in this International Standard. 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 7 and 8 (stage 2) which are relevant to the interface or equipment to which the stage 3 standard applies.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 11574:2000, *Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Circuit-mode 64 kbit/s bearer services - Service description, functional capabilities and information flows*

ISO/IEC 11579-1:1994, *Information technology - Telecommunications and information exchange between systems - Private integrated services network - Part 1: Reference configuration for PISN Exchanges (PINX)*

ISO/IEC 13864:1995, *Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Specification, functional model and information flows - Name identification supplementary services*

ISO/IEC 14136:1995, *Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Specification, functional model and information flows - Identification supplementary services*

ETS 300 387:1994, *Private Telecommunication Network (PTN); Method for the specification of basic and supplementary services*

ITU-T Rec. I.112:1993, *Vocabulary of terms for ISDNs*

ITU-T Rec. I.210:1993, *Principles of telecommunication services supported by an ISDN and the means to describe them*

ITU-T Rec. Z.100:1999, *Specification and description language (SDL)*

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4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1 External definitions

This International Standard uses the following terms defined in other documents:

- Basic Service (ITU-T Rec. I.210)
- Connection (ITU-T Rec. I.112)
- Private Integrated Services Network (PISN) (ISO/IEC 11579-1)
- Private Integrated services Network eXchange (PINX) (ISO/IEC 11579-1)
- Service (ITU-T Rec. I.112)
- Signalling (ITU-T Rec. I.112)
- Supplementary Service (ITU-T Rec. I.210)
- User (ISO/IEC 11574)

This International Standard refers to the following basic call functional entities (FEs) defined in ISO/IEC 11574:

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

This International Standard refers to the following basic call inter-FE relationships defined in ISO/IEC 11574:

- r1
- r2
- r3

This International Standard refers to the following basic call information flows defined in ISO/IEC 11574:

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

This International Standard refers to the following basic call information flow elements defined in ISO/IEC 11574:

- Call History (CH)
- Connected Number (CN)
- Connected Subaddress (CS)

This International Standard refers to the following Connected Line Identification Presentation information flow elements defined in ISO/IEC 14136:

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

4.2 Other definitions

4.2.1 Additional network feature

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

4.2.2 Alerting

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

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4.2.3 Answered

The state of the primary or secondary call after the called user has answered.

4.2.4 Call, basic call

An instance of the use of a basic service.

4.2.5 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.

4.2.6 Secondary call

The other call involved in the transfer.

4.2.7 Transfer by Join

The effecting of transfer by joining together the connections of the primary and secondary calls at User A's PINX.

4.2.8 Transfer by rerouteing

The effecting of transfer by establishing a new connection to replace all or part of the connections of the primary and secondary calls.

4.2.9 User A

The served user, i.e. the user requesting Call Transfer.

4.2.10 User B

The other user in User A's primary call.

4.2.11 User C

The other user in User A's secondary call.

5 Acronyms

AI	Alerting Indication
CC	Call Control (functional entity)
CCA	Call Control Agent (functional entity)
cfm	confirmation
CH	Call History (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
ED	End Designation (information flow element)
FE	Functional Entity
ind	indication
ISDN	Integrated Services Digital Network
LCI	Local Call Identities
PINX	Private Integrated services Network eXchange
PISN	Private Integrated Services Network
req	request
resp	response
RN	Rerouteing Number (information flow element)

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SDL	Specification and Description Language
SS-CT	Supplementary Service Call Transfer
TDR	Terminal Detail Request
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 users calls into a new call between the other two users of the two calls (User B and User C). Each call can either be 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 no longer be able to communicate with User A.

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 - The establishment of either call as part of a request for transfer is outside the scope of this International Standard. This International Standard 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 ISO/IEC 11574.

6.2 Procedures

6.2.1 Provision/withdrawal

SS-CT shall be generally available to all PISN users with the ability to invoke it.

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 a mixture of incompatible bearer capabilities.

NOTE 1 - It is User A's responsibility to ensure that the two calls are otherwise compatible.

Bearer capabilities shall 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 2 - The provision of interworking functions between different bearer capabilities is outside the scope of this International Standard.

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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 subaddresses 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 3 - 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 International Standard.

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 PISN standards were available at the time of publication of this International Standard 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 Completion of Calls to Busy Subscribers (SS-CCBS)

No interaction.

6.3.8 Completion of Calls on No Reply (SS-CCNR)

No interaction.

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6.3.9 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.

6.3.10 Path Replacement (ANF-PR)

No interaction.

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

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 PISN 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 PISN 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.

In the case where User B and User C are in the same network, the PISN may be able to cooperate with that network in order to effect Call Transfer in that network.

6.4.2 User A in another network

The PISN shall accept transfer notifications from another network and pass them on to the PISN 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 PISN 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 ITU-T Rec. Z.100. 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.

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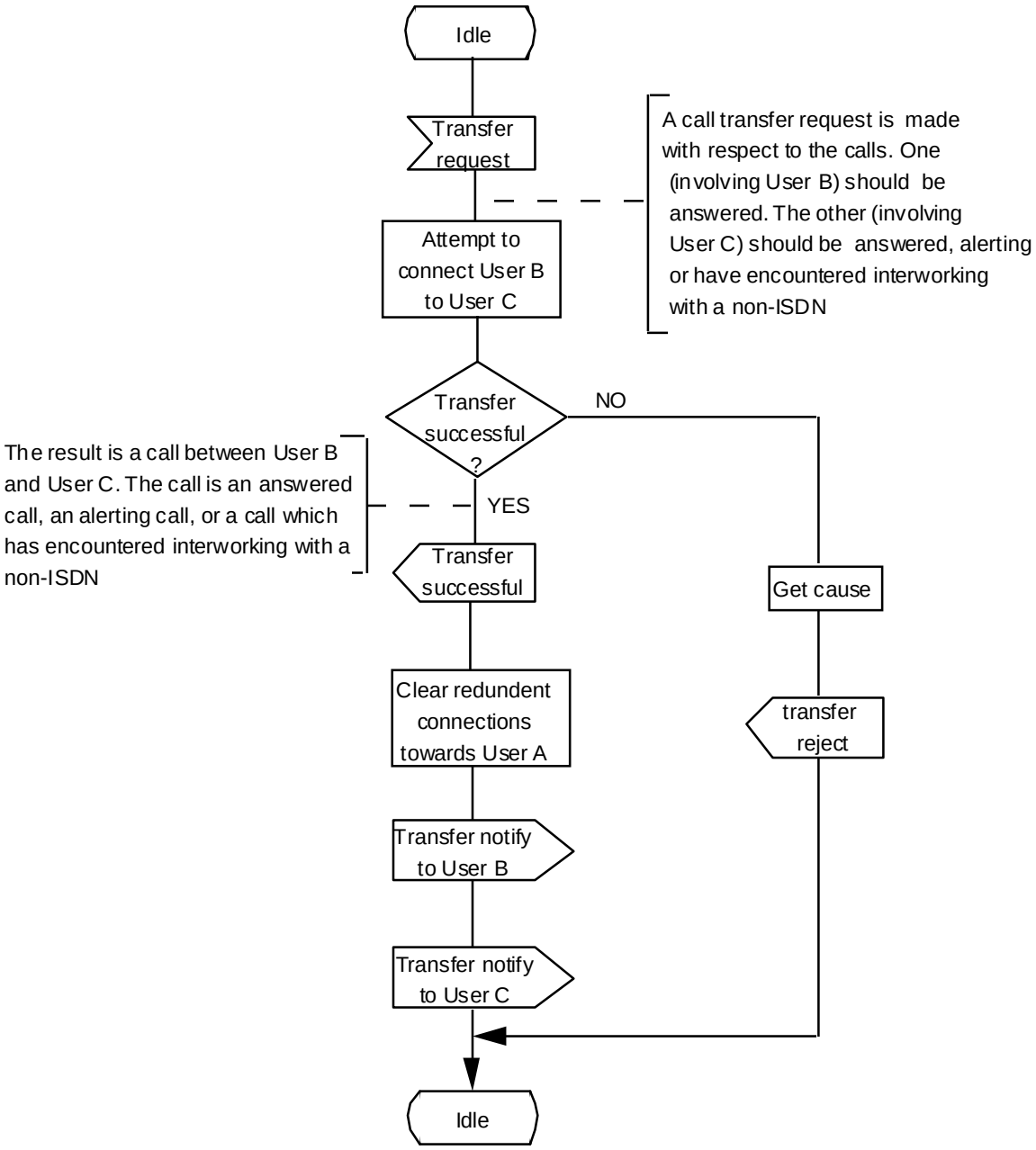

Figure 1 - SS-CT, Overall SDL

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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.

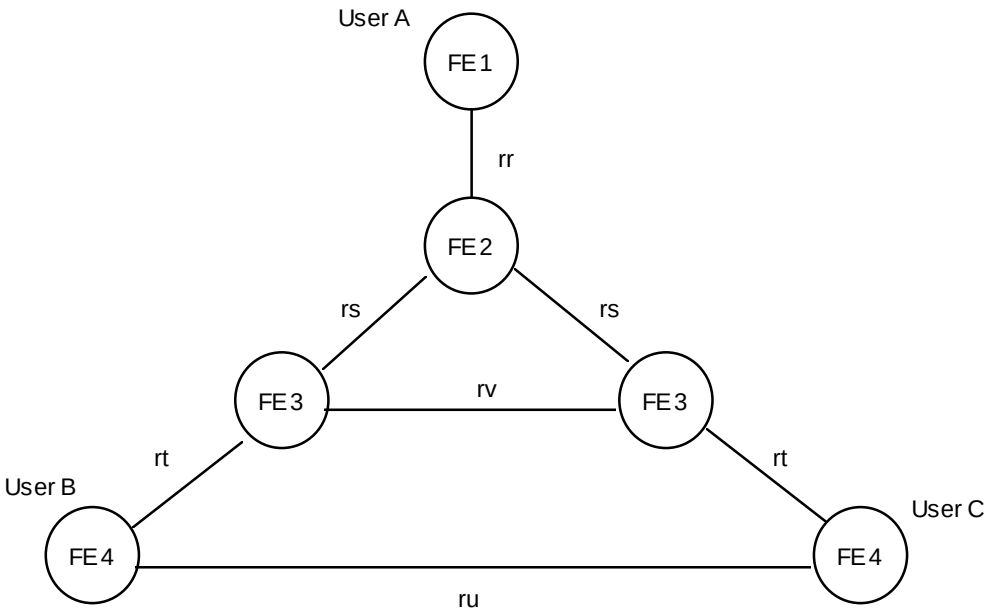

Figure 2 - Functional Model for SS-CT

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.

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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 FE 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 networks.

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 for the primary call, and the calling user of the secondary call.

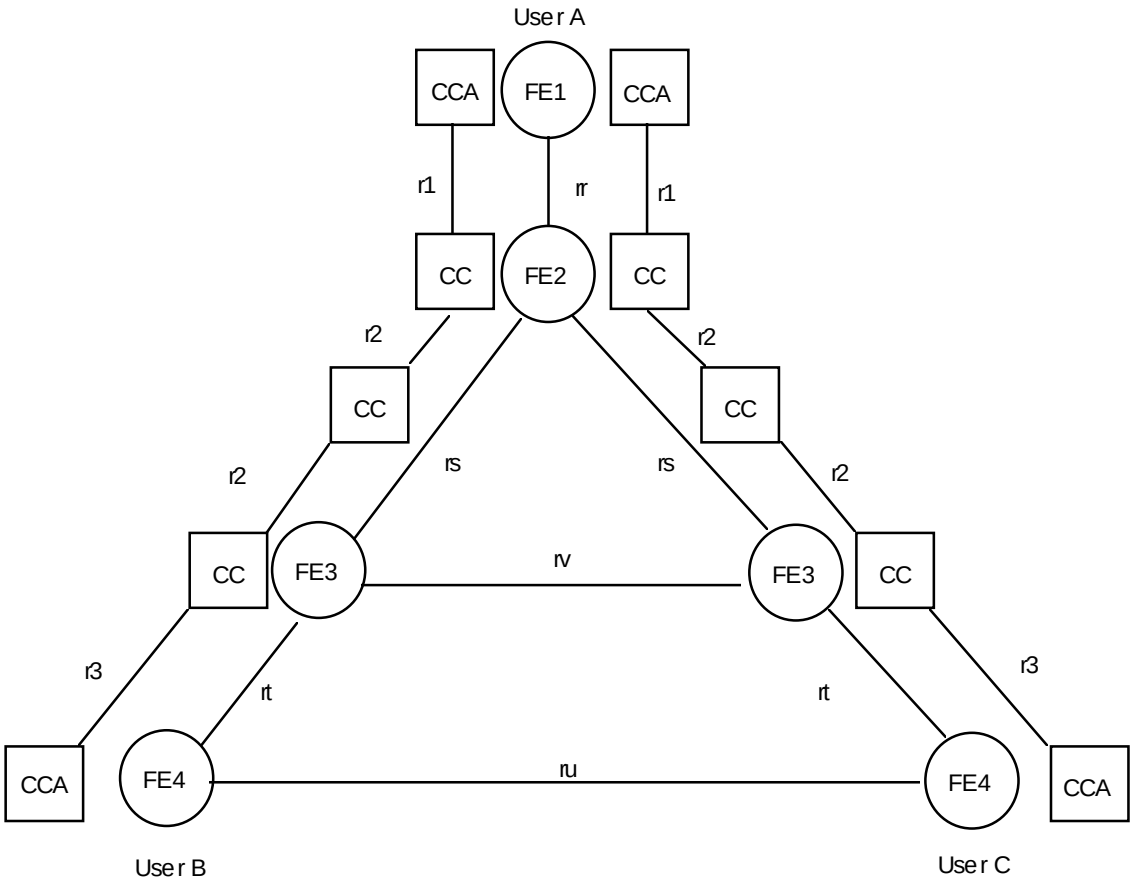

Figure 3 - Example relationship between model for SS-CT and Basic Call

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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 service elements within the Transfer Invoke information flow.

Table 1 - Content of Transfer Invoke

Service element	Request	Confirm
Local Call Identities (LCI)	M	-
Transfer Invoke Result (TIVR)	-	M

Service element LCI shall contains the identities of the two calls to be transferred.

Service element TIVR contains the result of the transfer invoke request and, if it indicates rejection, identifies 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 service elements within the Transfer Complete information flow.

Table 2 - Content of Transfer Complete

Service element	Request
Alerting Indication (AI)	O (NOTE)
Call History (CH)	O
Connected Name	O
Connected Number (CN)	O (NOTE)
End Designation (ED)	M
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.	

Service elements CN and CH are described in ISO/IEC 11574.

Service element AI contains User C's number and restriction details if User C's number is known.

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

Service element Connected Name shall comprise the service elements of information flow INFORM3 of ISO/IEC 13864.

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 service elements within the Transfer Active information flow.

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Table 3 - Content of Transfer Active

Service element	Request
Connected Name	O
Connected Number (CN)	M
Connected Subaddress (CS)	O

Service elements CN and CS are described in ISO/IEC 11574.

Service element Connected Name shall comprise the service elements of information flow of INFORM3 ISO/IEC 13864.

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 service elements within the Transfer Notify information flow.

Table 4 - Content of Transfer Notify

Service element	Request
Alerting Indication (AI)	O (NOTE)
Call History (CH)	O
Connected Name	O
Connected Number (CN)	O (NOTE)
Connected Subaddress (CS)	O
Terminal Details Request (TDR)	O
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.	

Service element CN is described in ISO/IEC 14136.

Service element AI includes details of the other user involved in the transfer if known and not restricted, its contents being identical to those of service element CN described in ISO/IEC 14136.

Service element CH is described in ISO/IEC 11574.

Service element Connected Name shall comprise the elements of information flow INFORM4 of ISO/IEC 13864.

Service element CS shall be as defined in ISO/IEC 14136 and shall be included only when available from information flow Transfer Active.

Service 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 service elements within the Terminal Details information flow.

Table 5 - Content of Terminal Details

Service element	Request
Connected Subaddress (CS)	O

Service element CS is described in ISO/IEC 14136.

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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 if User C's number is known.

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

Table 6 - Content of Transfer Update

Service element	Request
Alerting Indication (AI)	O (NOTE)
Call History (CH)	O
Connected Name	O
Connected Number (CN)	O (NOTE)
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.	

Service elements CN and CH are described in ISO/IEC 11574.

Service element AI contains User C's number and restriction details if User C's number is known.

Service element Connected Name shall comprise the service elements of information flow INFORM3 of ISO/IEC 13864.

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. Within a column representing an SS-CT functional entity, the numbers refer to functional entity actions listed in 7.3.

In the figures showing the information flow sequences the primitive and information flows are shortened as follows:

'request"	to	"req"
"indication"	to	" ind"
"response"	to	"resp"
"confirmation"	to	"cfm"

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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.

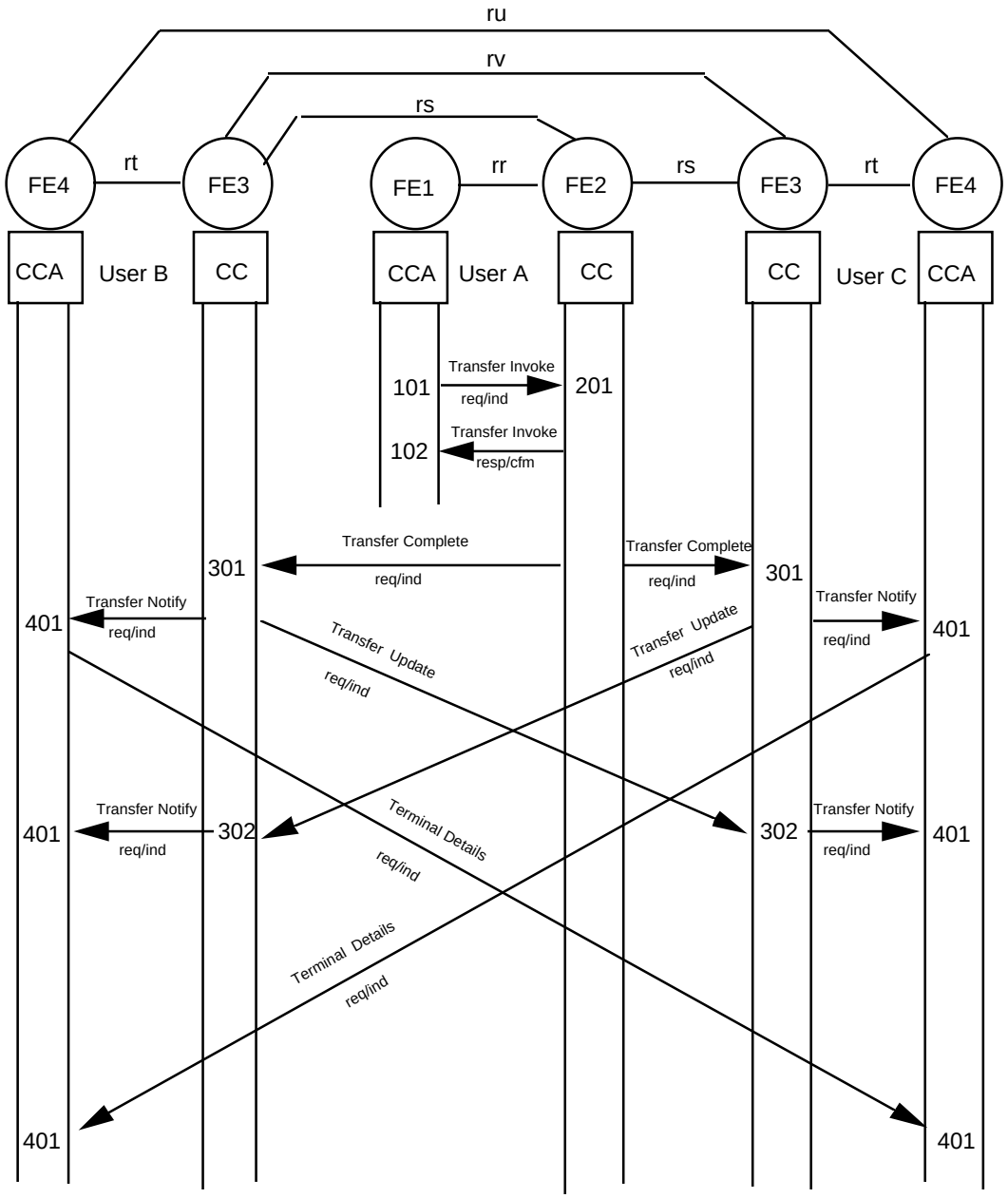

Figure 4 - Information Flow Sequence - Normal Operation of SS-CT (User C answered)

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

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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.

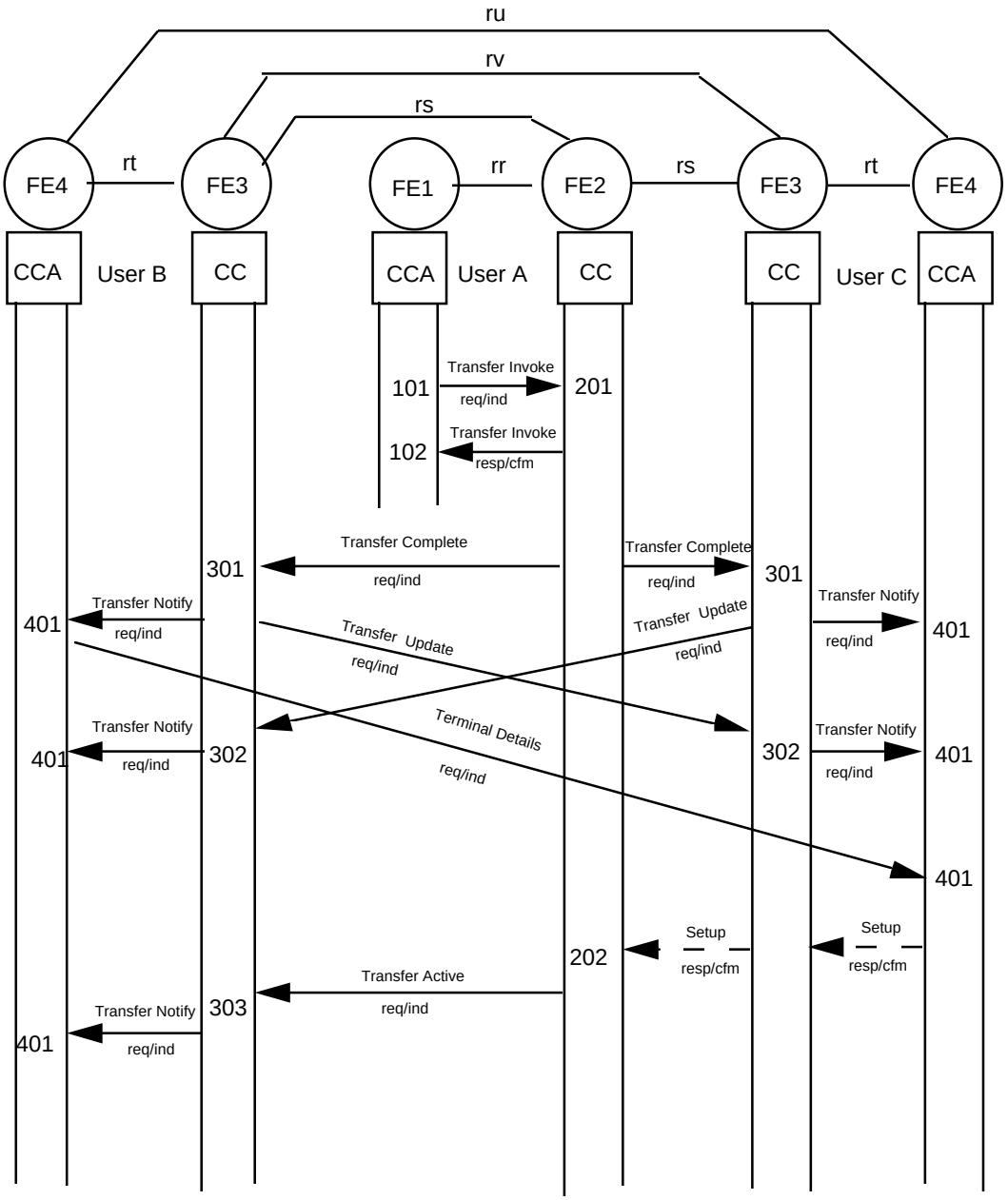

Figure 5 - Information Flow Sequence - Normal Operation of SS-CT (User C being alerted)

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 upon receipt of transfer Notify containing element Terminal Details Request.

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7.3 Functional Entity actions

The following FE actions shall occur at the points indicated in the figures of 7.2.3.

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 ITU-T Rec. Z.100.

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.

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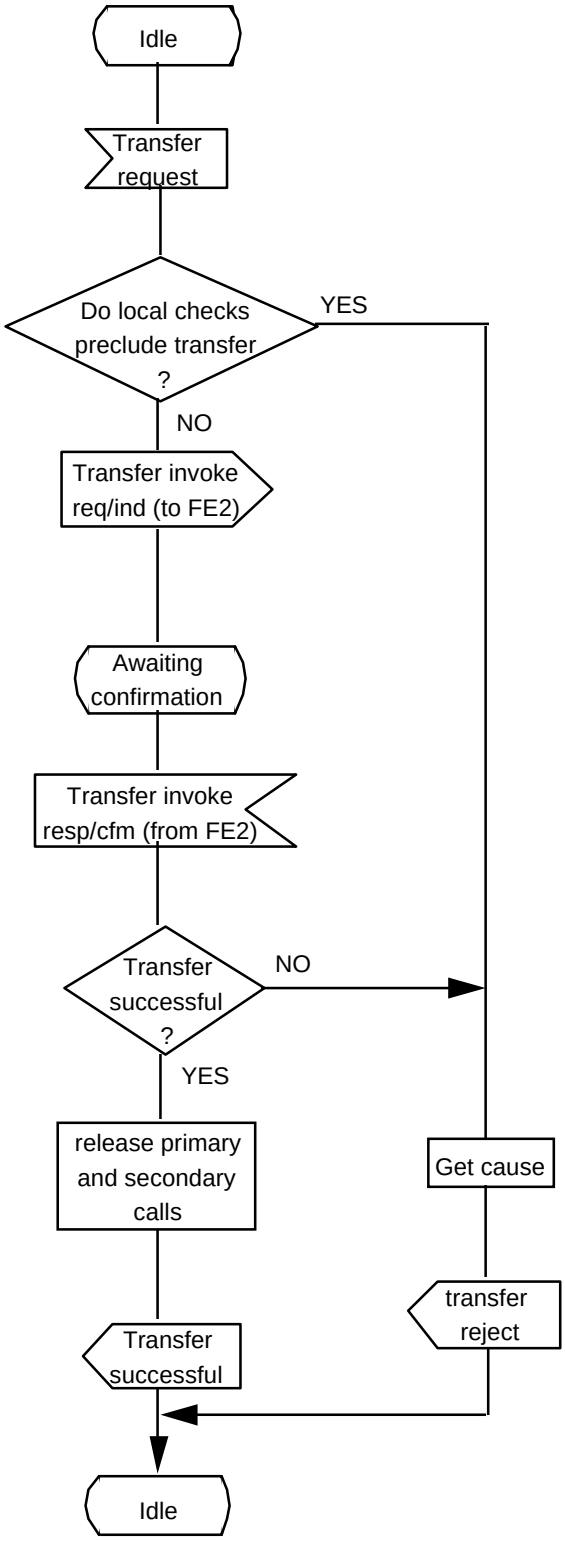

Figure 6 - SS-CT, SDL for functional entity FE1

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.

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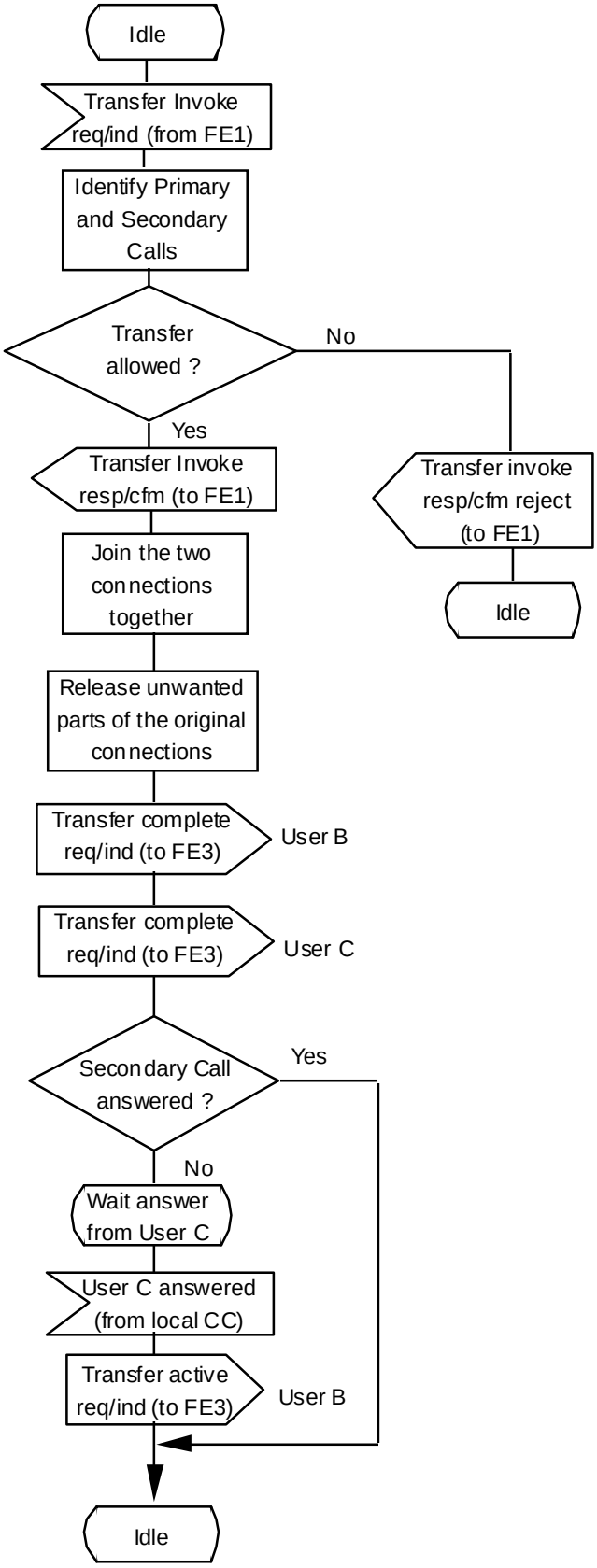

Figure 7 - SS-CT, SDL for functional entity FE2

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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.

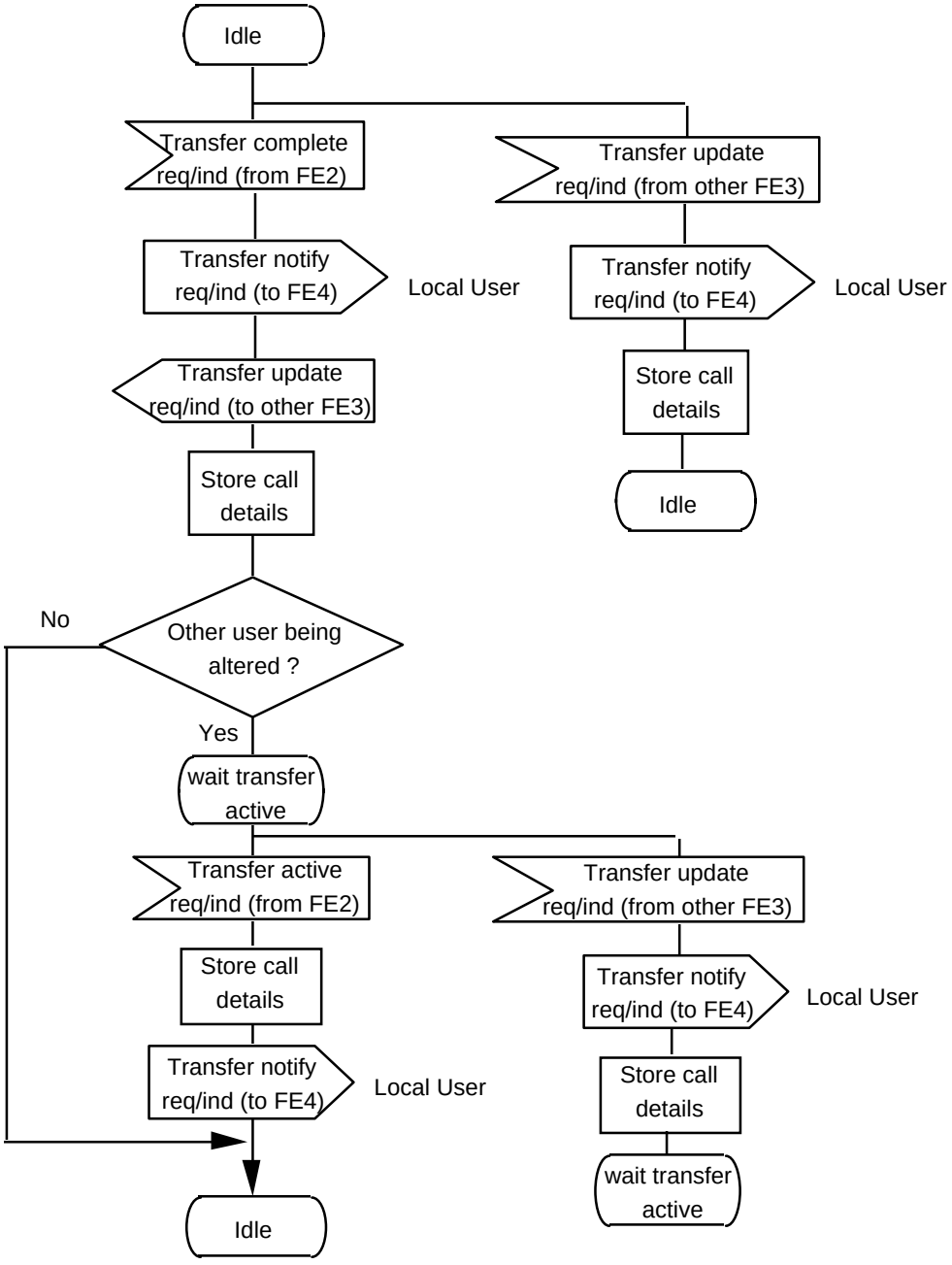

Figure 8 - SS-CT, SDL for functional entity FE3

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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.

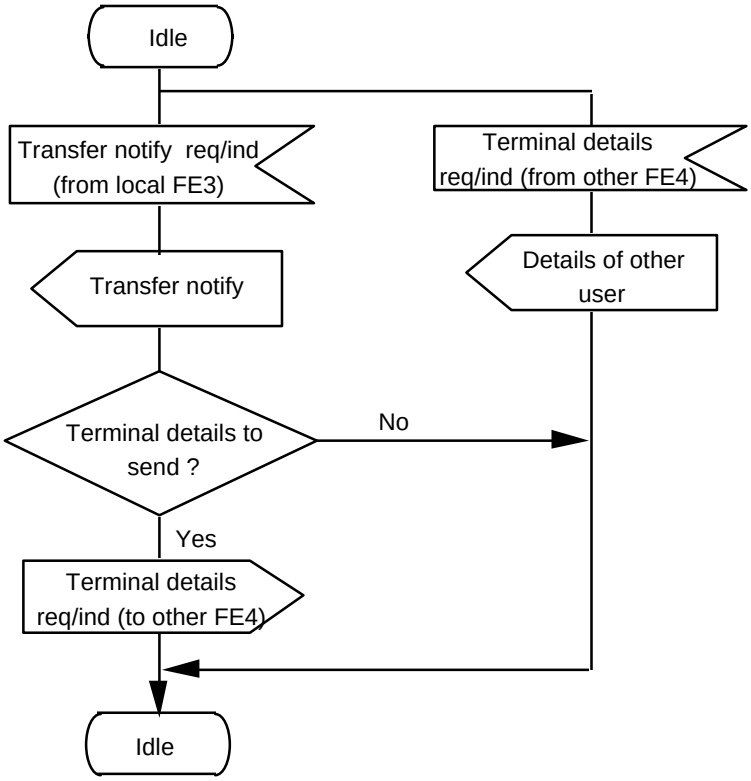

Figure 9 - SS-CT, SDL for Functional Entity FE4

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7.5 Allocation of functional entities to physical locations

The allocations of FEs to physical equipment shown in table 7 shall apply. In the table, "TE" represents a TE attached to a PISN. 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 PINX.

Table 7 - FE location scenarios

Scenarios		Functional Entities					
		User A		User B		User C	
		FE1	FE2	FE3	FE4	FE3	FE4
1	Intra-PISN transfer	TE	PINX	PINX	TE	PINX	TE
2	User A in PISN, Users B, C in other network	TE	PINX	gateway PINX	other network	gateway PINX	other network
3	Users A, B in PISN, User C in other network	TE	PINX	PINX	TE	gateway PINX	other network
4	Users A, C in PISN, User B in other network	TE	PINX	gateway PINX	other network	PINX	TE
5	User A in other network, users B and C in PISN	other network	other network	other network	TE	other network	TE
6	Users A, B in other network, User C in PISN	other network	other network	other network	other network	other network	TE
7	Users A, C in other network, User B in PISN	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 PINX 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 PINX or by the user's PINX may be used by that PINX.

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8 SS-CT stage 2 specification for transfer by rerouteing

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.

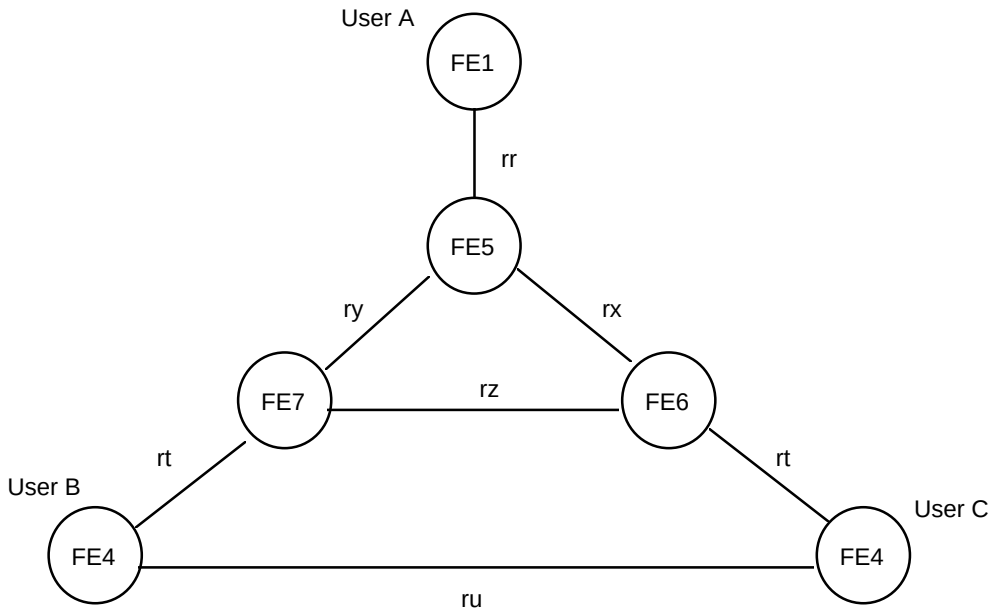

Figure 10 - Functional model of SS-CT

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8.1.2 Description of functional entities

8.1.2.1 Transfer Invoke Functional Entity, FE1

Subclause 7.1.2.1 shall apply.

8.1.2.2 Transfer Notification Receive Functional Entity, FE4

Subclause 7.1.2.4 shall apply.

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.

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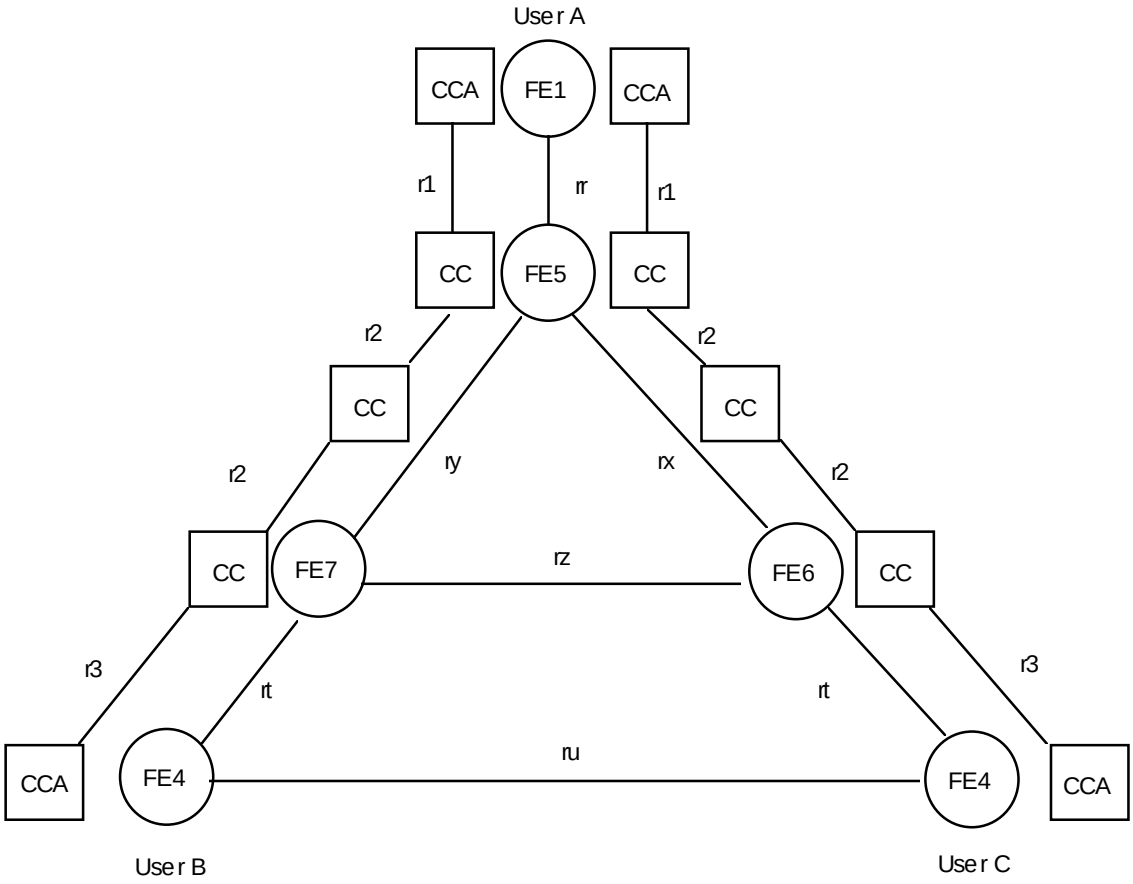

Figure 11 - Example Relationship between Model for SS-CT and Basic Call

8.2 Information flows

8.2.1 Definition of information flows

The following information flows shall be supported.

8.2.1.1 Transfer Invoke

Subclause 7.2.1.1 shall apply.

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.

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Table 8 - Content of Transfer Identify

Service element	Request	Confirm
Call Identity (CID)	-	O (NOTE)
Rerouteing Number (RN)	-	O (NOTE)
Transfer Identity Result (TIDR)	-	M
NOTE - Mandatory if request accepted.		

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 rerouteing 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 rerouteing 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	-
Rerouteing Number (RN)	M	-
Transfer Initiate Result (TINR)	-	M

Service elements CID and RN are as described 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 rerouteing 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 Rerouteing 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 all (Alerting) report.

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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
Alerting Indication (AI)	-	O (NOTE)
Call History (CH)	O	O
Call Identity (CID)	M	-
Connected Name	O	O
Connected Number (CN)	O	O (NOTE)
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.		

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

Elements CN and CH shall be as defined in ISO/IEC 11574.

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 INFORM3 of ISO/IEC 13864.

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 rerouteing 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.

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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.

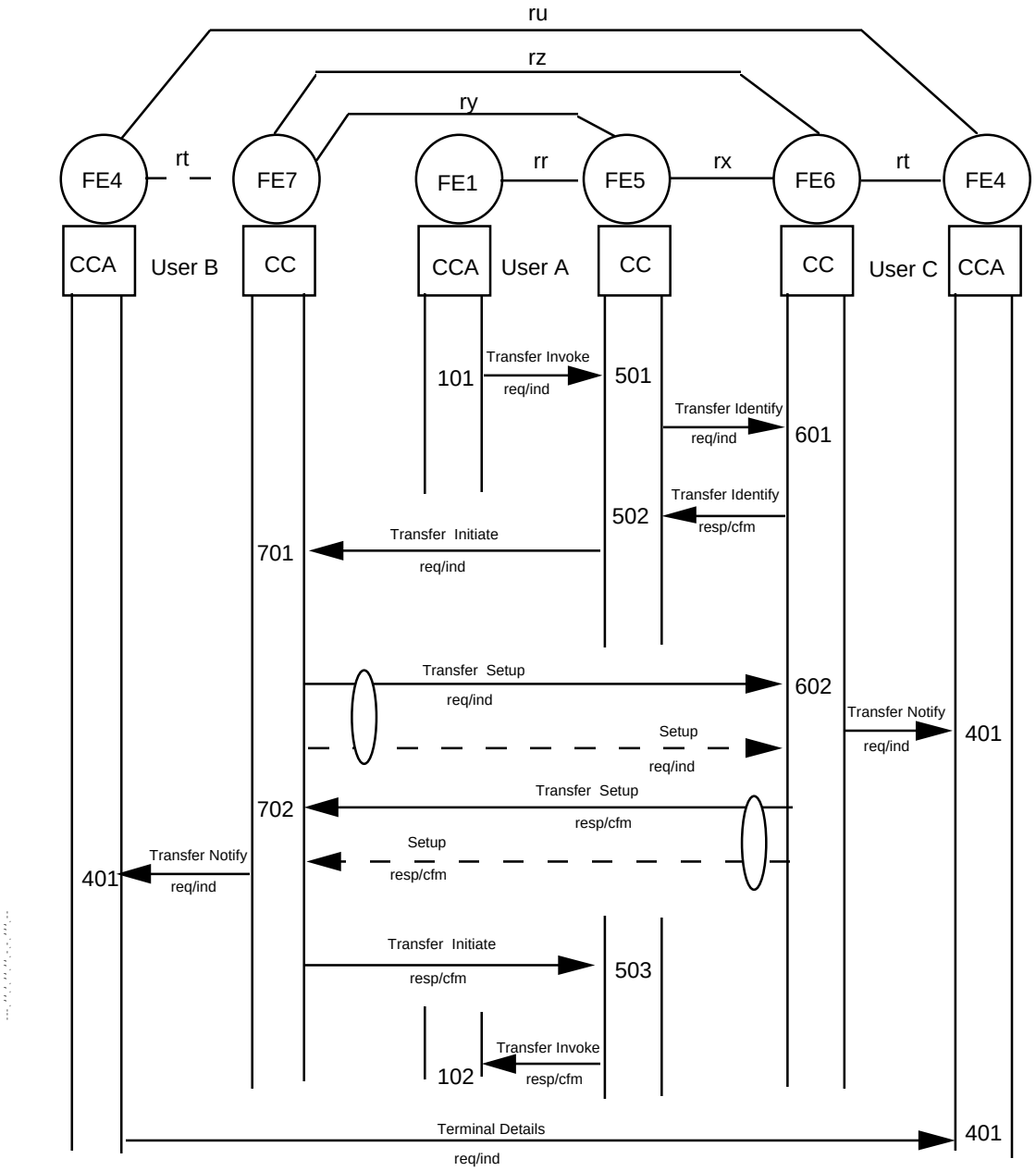

Figure 12 - Information Flow Sequence - Normal Operation of SS-CT (User C answered)

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.

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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.

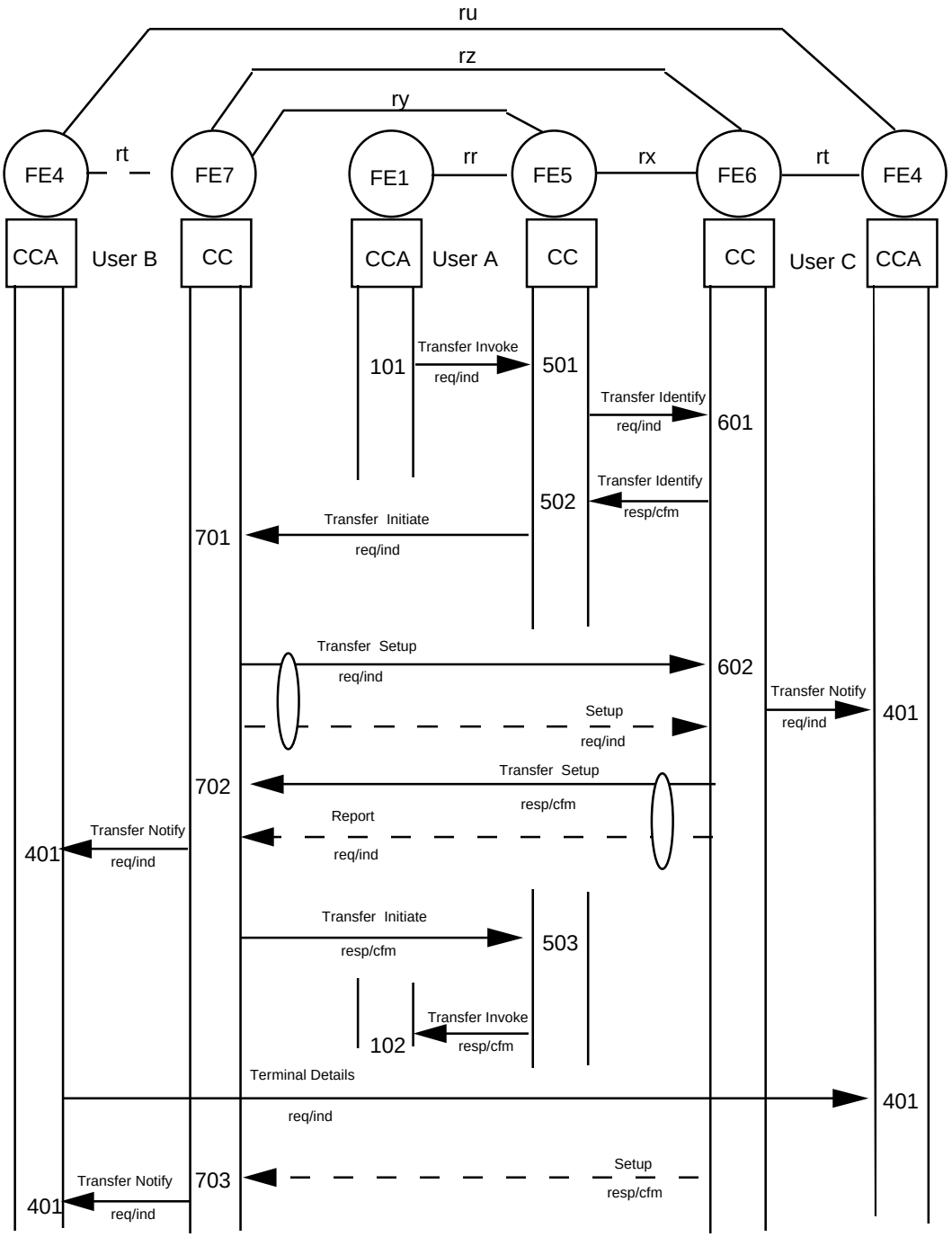

Figure 13 - Information Flow Sequence - Normal Operation of SS-CT (User C alerting)

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

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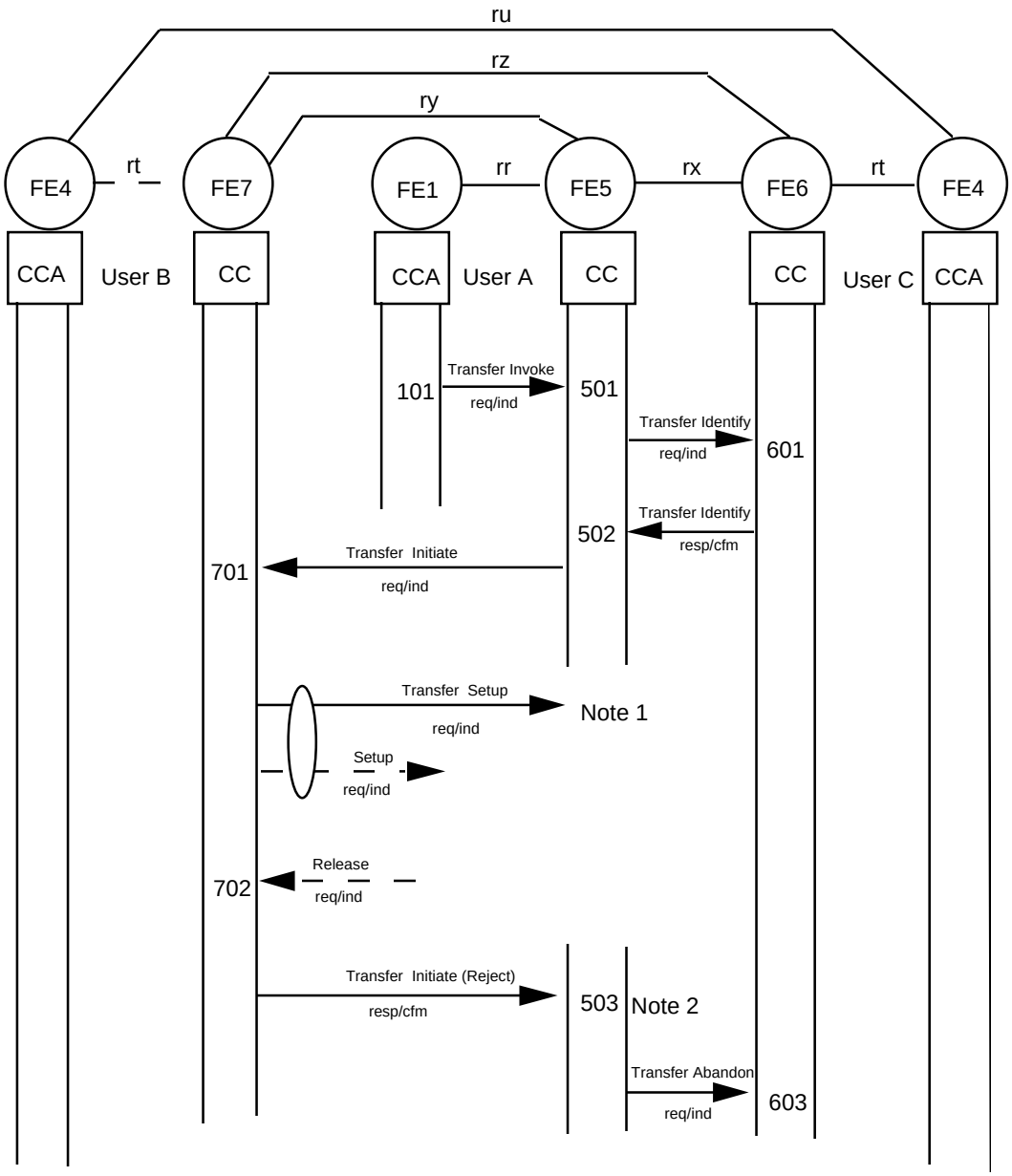
8.2.3.3 Unsuccessful Call Transfer (setup fails)

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



NOTE 1 - Basic call does not reach User C's PINX owing to congestion.

NOTE 2 - If transfer by rerouteing fails, transfer by join is invoked instead.

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

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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 rerouteing 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 ITU-T Rec. Z.100.

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.

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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.

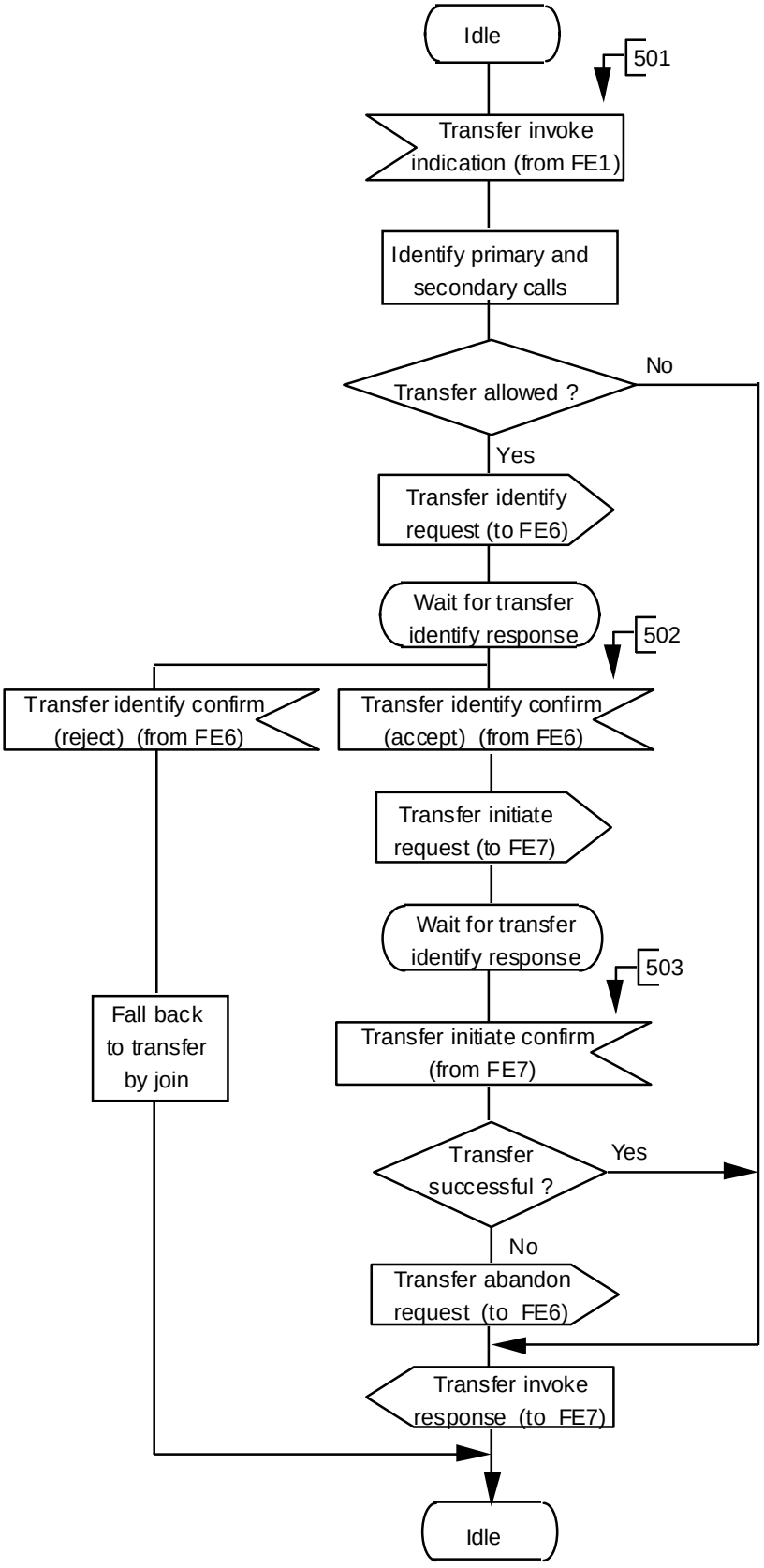

Figure 15 - SS-CT, SDL for Functional Entity FE5

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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.

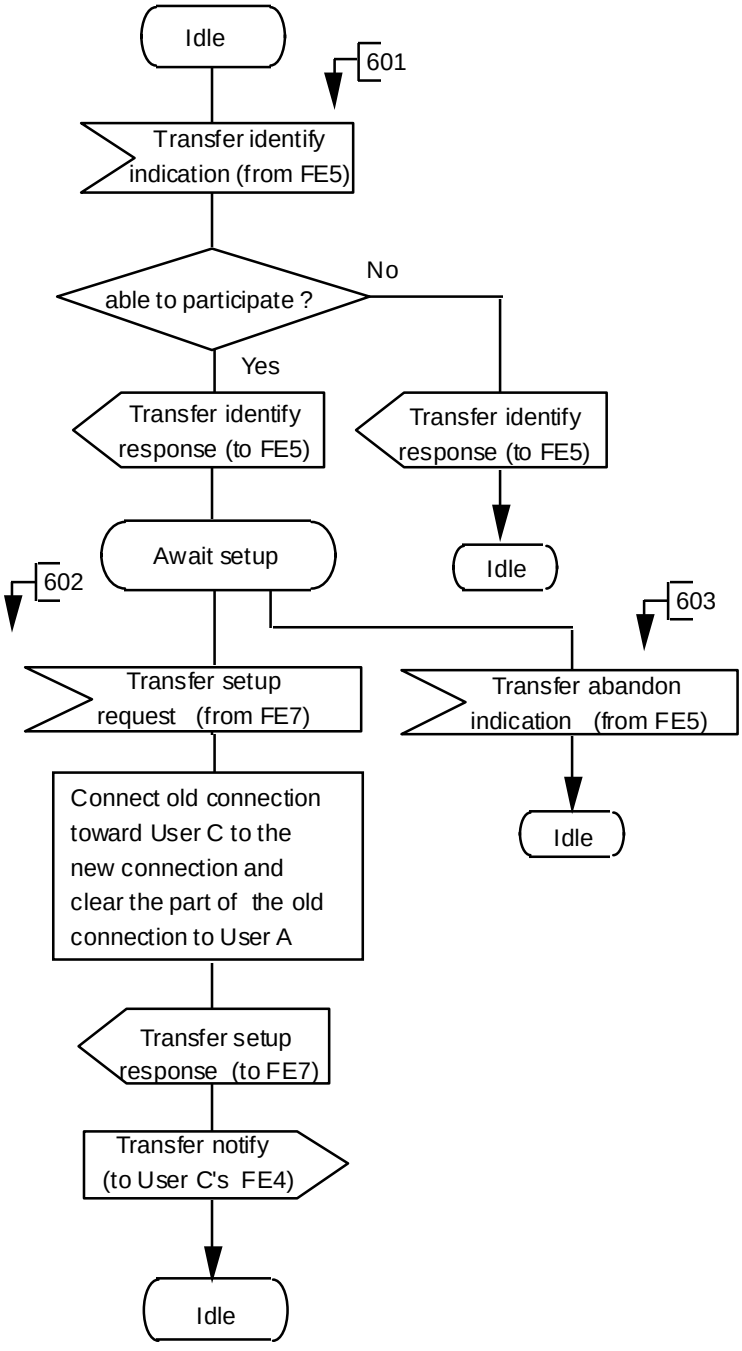

Figure 16 - SS-CT, SDL for Functional Entity FE6

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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.

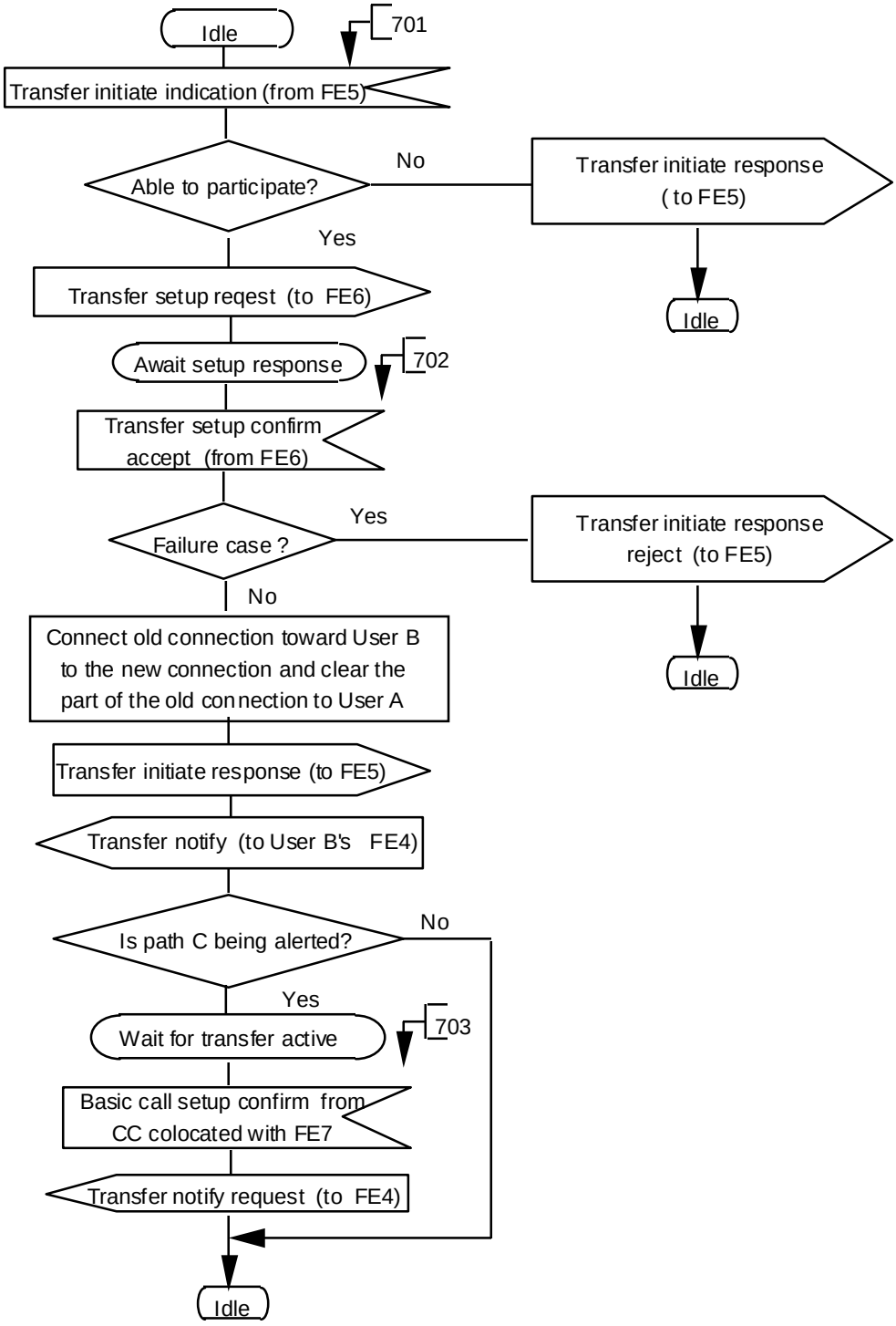

Figure 17 - SS-CT, SDL for Functional Entity FE7

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8.5 Allocation of functional entities to physical locations

Table 11 illustrates the various scenarios possible, excluding the cases of stimulus terminals. Where a terminal involved is stimulus with respect to transfer, any FE shown as residing in the corresponding user's TE shall reside instead in that user's PINX.

Table 11 - FE location scenarios

Scenarios		Functional Entities					
		User A		User B		User C	
		FE1	FE5	FE7	FE4	FE6	FE4
1	Intra-PISN transfer	TE	PINX	PINX	TE	PINX	TE
2	User A in PISN, users B, C in other network	TE	PINX	gateway PINX	other network	gateway PINX	other network
3	Users A, B in PISN, User C in other network	TE	PINX	PINX	TE	gateway PINX	other network
4	Users A, C in PISN, User B in other network	TE	PINX	gateway PINX	other network	PINX	TE
5	User A in other network, users B and C in PISN	other network	other network	other network	TE	other network	TE
6	Users A, B in other network, User C in PISN	other network	other network	other network	other network	other network	TE
7	Users A, C in other network, User B in PISN	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

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Annex A
(informative)

Bibliography

ITU-T Rec. I.252.7 Integrated Services Digital Network (ISDN), Explicit Call Transfer supplementary service, service description

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