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Foreword

This ETSI Technical Report (ETR) on generic user control procedures was produced by the Human Factors (HF) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

The intended users of this ETR include:

Table 1: Intended users and potential benefits

	User	ETR used for	Potential Benefit
1	Service and terminal designers	Development of user control procedures.	Increased usability through harmonized and supportive procedures.
2	Service providers	To assist the qualification of user control procedures.	Improved usability of services though comparison with generic procedures and rules.
3	User groups	To identify problems within user control procedures.	Increased awareness by user groups of user requirements for a consistent level of indications that support services.
4	ETSI Technical Committees	Development of standards that support user's control and indication needs.	Improved usability of services by ensuring provision of the communication paths from service provider to end-user.
5	TC-HF	Development of user control procedures.	Improved usability through consistency and coherence of recommendations.

Introduction

One of the missions of ETSI's Human Factors Technical Committee (TC-HF) is the recommendation of user control procedures for gaining access to and control of telecommunication services, initially for Videotelephony, but subsequently for Universal Personal Telecommunications (UPT), Supplementary Services, and Phone-Based Interfaces (PBI), etc. TC-HF's concern is that their recommendations for each of these services should not only be optimal for the individual service, but should also be consistent and coherent with each other. Consequently, to minimize the risk of inconsistency, an overall concept for user control procedures has been developed.

This concept is based on an understanding of telecommunication services and user procedures aspects in telecommunications, that has already been done or is under consideration in standardization bodies. It strives to include a generic concept for user interaction, a list of general rules that should govern the design of user procedures and a generic framework of user control procedures within telecommunications. To demonstrate the application of the concept, framework and rules this set of generic user control procedures has been developed as a first elaboration.

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1 Scope

This ETR presents a generic concept and framework for user control procedures and user interaction with telecommunication terminals and services, and uses these to extrapolate a set of general rules and a general principle for user control procedures and proposes a series of generic user control procedures for the basic point-to-point call.

It is intended that this ETR can provide guidance to:

- telecommunication terminal and service designers;
- telecommunication service providers;
- telecommunication user groups, concerned with the usability of telecommunication services;
- other Technical Committees within ETSI;
- TC-HF and in particular to STC HF1.

As a minimum it is hoped that these groups will make particular use of the following:

- the general rules for user control procedures;
- the general principle for user interaction, i.e. "Indicate - Control - Indicate";
- the generic user control procedures, as they apply to basic point-to-point calls.

2 References

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

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

[2] van Hardeveld, J.W. and Mierop, J.R. (1988): "The basic dialogues for ISDN services", 12th Symposium on Human Factors in Telecommunications, The Hague 1988.

[3] Bennett, R.W. and Klinger, J.G. (1990): "Conceptual models of telephony and their implications for interface design", 13th Symposium on Human Factors in Telecommunications, Turin 1990.

[4] ETR 051 (1992): "Human Factors (HF); Usability checklist for telephones, Basic requirements".

[5] CEPT Recommendation T/CAC 02 E: "Subscriber control procedures for supplementary services in modern telecommunications".

[6] CEPT Recommendation T/CAC S 10 E: "Service and Facilities Aspects of an Integrated Services Digital Network (ISDN)".

[7] CEPT Recommendation T/CAC S 10.7 E, annex 0.2: "User operation of supplementary services".

[8] ETS 300 511: "European digital cellular telecommunication system (Phase 2); Man-Machine Interface (MMI) of the Mobile Station (MS) (GSM 02.30)".

[9] CCITT Recommendation E.131 (1988): "Subscriber control procedures for supplementary telephone services".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of this ETR the following definitions apply:

Control (C): An end-user input to a terminal, network or service that is intended to change the state of the terminal, network or service as part of a control procedure to gain access to and control of a telecommunication service.

control procedure: A sequence of control actions, terminal, network or service indications and wait states, that facilitate the access to and control of telecommunications services.

user: The person who uses a telecommunications terminal to gain access to and control a telecommunications service. The user may or may not be the person who has subscribed to the provision of the service and may or may not be a person with special needs, e.g. elderly or disabled.

Indication (I): Information, with respect to the state of the terminal, network, or service, that is provided to an end-user as part of a control procedure to gain access to and control of a telecommunication service.

subscriber: The user or collection of users who has made arrangements with a network provider to have connection with a telecommunications network and who may make arrangements for the provision of telecommunications services via that network with a service provider.

Wait State: The state of a terminal, network or service that exists prior to a control action from the end-user, terminal, network or service that will initiate progress to the next state within a control procedure.

3.2 Symbols

For the purposes of this ETR the symbols used within the Specification Description Language (SDL) figures are defined in ITU-T Recommendation Z.100 [1] (see figure 9).

3.3 Abbreviations

For the purposes of this ETR the following abbreviations apply:

AOC	Advice of Charge (Supplementary Service)
C	Control
CF	Call Forward (Supplementary Service)
CLIP	Calling Line Identification Presentation (Supplementary Service)
CLIR	Calling Line Identification Restriction (Supplementary Service)
COLP	Connected Line Identification Presentation (Supplementary Service)
COLR	Connected Line Identification Restriction (Supplementary Service)
CW	Call Waiting (Supplementary Service)
DDI	Direct Dialling In (Supplementary Service)
GSM	Global System Mobile
HOLD	Hold (Supplementary Service)
I	Indication
ISDN	Integrated Services Digital Network
MOU	Memorandum of Understanding
MSN	Multiple Subscriber Number (Supplementary Service)
N	Network
NDNB	Network Determined User Busy
PBI	Phoned-Based Interface
PSTN	Public Switched Telephone Network
PWSN	People with Special Needs
SDL	Specification Description Language
T	Terminal
TC-HF	ETSI Human Factors Technical Committee
TP	Terminal Portability (Supplementary Service)
UDUB	User Determined User Busy

UPT	Universal Personal Telecommunications
W	Wait (as in Wait State)

4 Generic concept of user interaction

This clause describes the generic concept for user interaction which can be applied to telecommunications. The concept takes the form of a three layer model. From this, and good human factors practise, the set of general rules for the preparation of user procedures has been developed. Finally, a three dimensional framework is proposed for identifying and perhaps classifying the range of user procedures applicable within telecommunications.

4.1 Three layer model

The proposed generic concept of user interaction with user control procedures within telecommunications takes the form of a three layer model (see figure 1). The model starts from the amorphous understanding that users may have of telecommunications, in the form of **User Models**; and progresses through the more concrete understanding of specific tasks the user needs to complete to achieve their communication goals, **User Tasks**; to the base level of physical **Controls and Indications**. The three layer model is a development and amalgamation of earlier work by van Hardeveld and Mierop (1998) [2] and Bennett and Klinger (1990) [3].

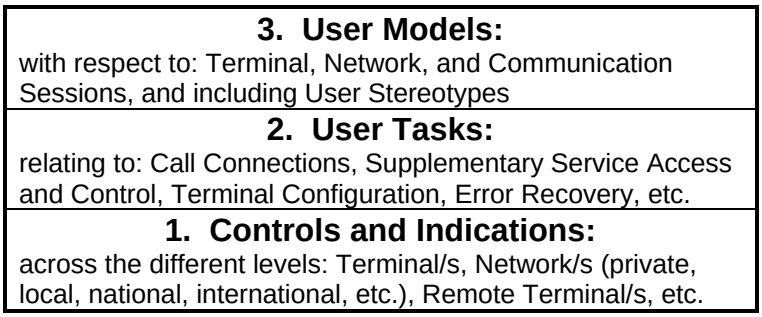

Figure 1: The three layer model of a generic concept of user interaction

In many ways the idea of three layers as a concept for user interaction within telecommunications is simply a parallel of the classic four layer model for general human factors. This is the one that uses four concentric circles, labelled **Environment, Workspace, Machine, Man**. The model is usually drawn with man at the centre and environment at the periphery, in an attempt to emphasize the human centred approach of human factors (see figure 2). In our case, **User Models** might be considered the mental environment for any telecommunication interaction, **User Tasks** would then be the workspace, and **Controls and Indications** the machine elements that the users (men, and women?) need to activate and monitor.

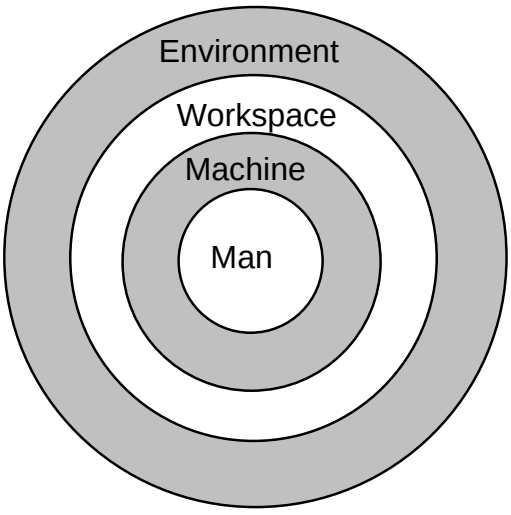

Figure 2: General four layer model reflecting the human factors perspective

Indeed, the three layer model can be drawn in any number of ways, e.g. as concentric circles, as three levels of a pyramid, as vertical or horizontal bars, etc. The choice depends on what might need to be emphasized. For example, to show the gradual refinement and progression from the amorphous to the concrete, the three layers could be shown filtering through a funnel from the **User Models** at the top, to the **Controls and Indications** dripping from the bottom. For the present purposes, a diagram showing simplicity and equality will suffice. Hence, figure 1 shows the model in a simple block form. Each layer contributing to the success of the total interaction. The apparent reverse (bottom up) order: **Layer 1 = Control and Indications, Layer 2 = User Tasks, Layer 3 = User Models,** reflects the similar ordering from the specific to the less specific used in many other conceptual models.

4.1.1 User Models

Recent tradition within user interface design called on the design of the interface (the organization and sequencing of elements, the structure of the display, etc.) to reflect the user's model of the product or task the system was supporting or replacing. This requirement though was often easier to say than to implement. As Bennett and Klinger (1990) [3] report, even people who use telephones regularly within their job have very poor understanding of how it works. The most common model reported noted that both users have a telephone and that somewhere there is a wire connecting the two (A). There was no understanding of how that wire changed to make different calls, or how different services were implemented. The second most common model was based on the notion of an "automatic operator" somewhere in the system, which connected telephones together in response to digits dialled or buttons pushed on the terminal (C). For the first group of users, facilities like Call Waiting or Call Forwarding were a complete mystery, for the second these were explained away perhaps by the "intelligence" of the "automatic operator". A third, smaller group of users seemed to assume that the controlling "intelligence" was all in the terminal. There were apparently some shared facilities which each terminal could use, but facilities like Call Waiting and Call Forwarding were handled by each individual terminal (B). In this model apparently, if the terminal is busy, Call Forwarding could not take place. A fourth group of users (25% of the sample) did not put forward a discernable model. It is quite clear from this work that, probably, the vast majority of users have very limited and inaccurate models of how basic telephony works. The workings and effects of Integrated Services Digital Networks (ISDN) on telecommunications will then, obviously, be totally obscure.

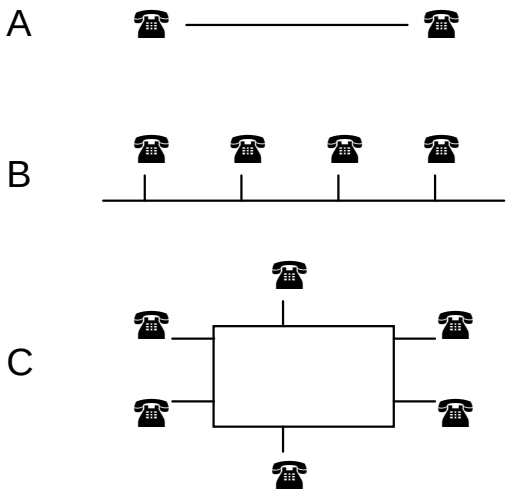

Figure 3: Three user models of telephony (after Bennett and Klinger, 1990 [3])

The user models that Bennett and Klinger [3] elicited showed three possibilities, either there was no "intelligence", or if there was "intelligence" then it was either in the telephone or the network. If the study had gone further, it may well have found that some people have two or three models, which they apply at different times to accommodate different requirements. It is easy to envisage that a user may have a working model of how the telephone behaves, another slightly different model on how a facsimile behaves, a third model of how the network between any pair of terminals works, and even a fourth model of how communications sessions need to be transacted. Each of these models is useful to their user in their own right, and they may or may not integrate or be consistent with each other. For example, there are several users who think in terms of separate telephony and facsimile networks, even though they are aware that the telephone and facsimile number construction is the same. For these users there is no problem in using both services, until perhaps they accidentally telephone a facsimile line.

It is fair to say that these simplistic models have served well over the past fifty or so years, however it is difficult to see how users will cope with ISDN without a better understanding of both the terminals capabilities and those of the network, or networks. This will be particularly true for multi-service, multi-line and multi-party calls. Even now, within the PSTN, it can be helpful to have an understanding of the connections employed in providing a telephony link, e.g. to understand differential charges, to handle different security requirements, to accept long post dialling delays, to manage the problems of congestion and the opportunities of error correction, etc. (van Hardeveld and Mierop, 1988) [2].

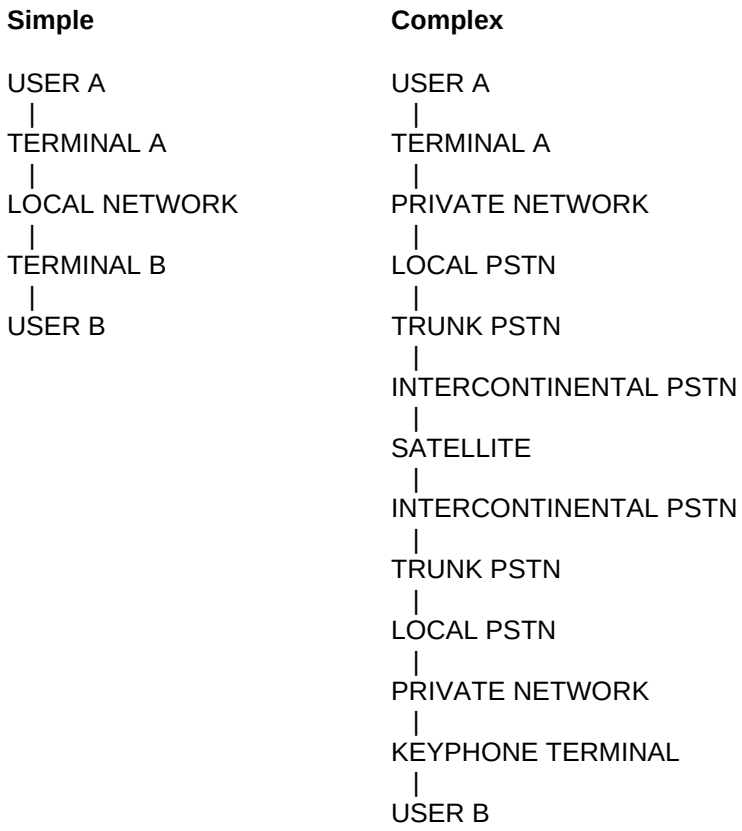

Figure 4: Different telephony links

The existence of user's models of telecommunications and user interactions is indicated by the stereotypes users demonstrate within task scenarios. For example, the very strong stereotype that replacing the handset will terminate a call can cause the user interpersonal discomfort and problems if this is used as the last control action required in a call transfer task, i.e. to transfer a call - press "R" (to get dial tone), dial the number, hang-up.

4.1.2 User Tasks

The essential purpose of telecommunications is to enable a link between two or more users to allow them to communicate. The terminal simply provides each user with access to the network, and the network provides the connectivity. In order to establish a communication link, there are, therefore, three basic tasks which all users have to learn; the ability to set up a call, the ability to answer a call and the ability to end a call.

Within the single service environment, for the user to set-up a call is a very basic two step task:

1) indicate a start (to the terminal and to the network) - e.g. lift handset;
2) indicate an address (to the network) - e.g. dial a number.

To answer a call is, of course, equally simple:

a) recognize a call alert - e.g. ring signal;
b) indicate a start to communicate - e.g. lift handset.

To end a call is even simpler:

- indicate a stop to communication - e.g. replace handset.

The simple knowledge of these three tasks; together with the basic instinct "if it doesn't work first time, try again", and the common knowledge that calls will have to be paid for, are all that probably 90% of users need or care about, to satisfy their telecommunications requirements. The remaining 10% or so of users are the few who make use of the terminal and network services (private and public), to extend or facilitate their communication needs.

For van Hardeveld [2], the activities of the user are represented by what is termed a "Session Model". A session is defined as a set of activities and events aimed at executing a task. Every session has three phases: a start, a task and a stop; and during any phase of a session other sessions can be started. In this way sessions can be linked or nested together. These sessions, or user tasks, can relate to any function of the terminal, or any function of the network, or even of the remote terminal, and can accommodate the whole communication task. To support this description, five basic sub-dialogues are identified which can be initiated by the user or by the system. These sub-dialogues are: Start, Accept, Switch, Stop and Conflict. The Start dialogue, starts a session. The Accept dialogue is a special case of start, it accepts and starts the communication at the distant end. The Switch dialogue enables the user to switch between current sessions. The Stop dialogue terminates a session, and the Conflict dialogue is invoked when the system detects a conflict in demands or facilities. The objective of the Conflict dialogue is to give guidance to the problem and to give directions on possible options.

The value of these ideas to the three layer model, is that it encapsulates the basic elements of any user task or procedure. There needs to be a recognizable start point, there may well be a central task or set of subtasks with options, and there needs to be a recognizable stop point. Any subtask that is nested within the main task, also needs a recognizable start, and a recognizable stop. Therefore a very basic, but global, task model can be defined (see figure 5).

Start	
TASK	
	Start
	Subtask
	Stop
Stop	

Figure 5: A simple user task model

When considering this model two facts should not be ignored. The use of defaults will enable start actions to be combined in effect, i.e. the user will progress straight to a specific nested task or subtask. For example, pressing a directory key may switch the terminal on from standby, connect the terminal to a second terminal via a local network, and display the first page of the directory from the second terminal. In the same way, stop actions may be combined to close a number of subtasks simultaneously. The most obvious example is the use of "escape" or "home" to exit from a set of procedures and return to a known base point.

4.1.3 Controls and indications

The basic level of the three layer model is concerned with the details of the controls and inputs necessary to progress a procedure, and the display indications necessary to show the status of the terminal or network. These are the building bricks of all user control procedures.

It is a basic human factors principle that a user should be given feedback, following a control action made by the user. Feedback is information on the changes induced because of, or caused by, the controls action. It satisfies a basic psychological instinct to relate causes and effects. There are, in fact, two pieces of information the user needs, the knowledge that the control did activate, and also the knowledge or how the system responded. However, in order to sensibly use a control or system, it is essential to know two other pieces of information. The current status of the system and the current status of the control. With these four pieces of information together the users can assess, the impact and effect of their control actions. For example, before making a telephone call the user needs to know that the telephone is at idle, and that the handset is on its rest. After lifting the handset, the dial tone confirms two things, one, that the hookswitch worked, and two, that the network is ready to receive an address. Admittedly this is a very

simple example, but the essential principle remains true for all user procedures or control dialogues and whatever the task.

Therefore, throughout any user procedure description it should be possible to detect the simple sequence: INDICATE - CONTROL - INDICATE, (see figure 6). This simple model shows the two elements which need to be indicated, both before and after the controls action. However, for most applications where, for example keys or pushbuttons are involved, the indication of the controls activation is given by the control's movement. There is no separate indication provided by the display. In more complex systems particularly if the control is activating a remote function, e.g. the zoom on a remote camera, there may well be a need to confirm that the local control action has been recognized and transmitted. This can be equally true of the indication of the system and control status given before the control is activated.

INDICATE: System Status
INDICATE: Control Status
CONTROL ACTION
INDICATE: Control Status Change
INDICATE: System Status Change

Figure 6: The basic I-C-I principle for controls and indications

There is one more provision that needs to be accommodated within the general model. This is the fact that it is most usual for the indication giving feedback on one control action forms the status information for the subsequent control action. Therefore it will be the norm to find indicate - control - Indicate - Control - Indicate, etc. within any procedural task. For example:

Indicate	-	Show "Window" display;
Control	-	Move mouse;
Indicate	-	Show cursor movement;
Control	-	Position mouse;
Indicate	-	Position cursor on icon;
Control	-	"Click" mouse;
Indicate	-	"Open" icon.

4.2 General rules

The following set of twelve rules have been developed from the requirements of the proposed concept, research literature and from good human factors working practises. It is not the intention that these rules should be mandatory, in the development of any set of user procedures. They are offered to provide guidance only.

Table 2: Twelve general rules for user control procedures

1	A user procedure comprises a sequence of user control actions and equipment display indications targeted to enable completion of a user's task or sub-task.
2	Every control action requires a clear indication of the status of the system and of the control before the action, and a clear indication (feedback) of the change in status of the control and the system after the action.
3	A user control action is necessary to initiate and complete any task or sub-task. A single action may complete one task and initiate a new task, if the action is explicit in both tasks. Similarly, a single action may complete a number of nested or parallel tasks, if the action and the corresponding indication explicitly confirms the multiple effect.
4	Any change of status of the system (terminal, network, remote terminal) that affects the user's interaction with the system needs to be indicated to the user. Interruptions to a user's task that are initiated by the system (including a remote user's actions) should accommodate the current task, and facilitate the user's choice over the available options.
5	All indications to the user whether static or transitory, need to be appropriate, discriminable, comprehensible and timely, within the range of physical and mental capabilities of the possible user population (with due reference to People with Special Needs (PWSN)).
6	All control actions required to operate the system need to be within the range of the physical and mental capabilities of the possible user population (with due reference to People with Special Needs (PWSN)).
7	No indication, control action or status of the system should threaten the physical or mental well-being of the possible user population.
8	Any procedure necessary to complete a task (or sub-task) should be concise, consistent, comprehensible and complete; commensurate with minimum user errors and congruent with targeted user preference levels.
9	Any set of procedures which relate to a set of tasks (or sub-tasks) need to demonstrate the qualities of consistency, flexibility, compatibility, self-explanation and user task orientation, to support the user's modelling or comprehension of the tasks and the system.
10	All procedures should support a simple and comprehensive error recovery strategy to enable the user to backtrack and/or exit from erroneous control actions. As far as possible, error recovery should not be penalized by any loss of data or of the communication path.
11	New procedures should be tested by a representative sample of people drawn from the possible user population (with reference to People with Special Needs (PWSN)) and evaluated against previously established criteria of usability.
12	Disregard any or all of the above rules in the interests of developing user control procedures and user interfaces which have a proven higher level of usability.

4.3 Generic framework

The generic framework proposed takes the form of a three dimensional framework for identifying possible user procedures. The three dimensions of the framework are: User Tasks, Telecommunications Services, and Error Sources. This framework is in the early stage of development. Currently, it is a proposal for TC-HF to consider if it is a useful tool for identifying and recording the user procedures TC-HF is, or needs to be working on. The three axes of the proposed framework are subdivided as follows.

The Telecommunications Services dimension is split into bearer services, teleservices, supplementary services, terminal services, and Value Added Services. The inclusion of bearer services may be inappropriate if they make no specific or individual demands on the user's procedures. There is also a question about the role of Value Added Services, even though these undoubtedly impact the user procedures controlling these services. They are included at the present because of the work that has been ongoing in the field of Phone-Based Interfaces (PBIs). The third question relating to services is where to locate Global System for Mobile communication (GSM) and Universal Personal Communications (UPT). The former is in many respects dependent upon the radio aspect of the service so is temporarily included as a bearer service. The second is included with terminals as one major impact is on the terminal services that define a UPT phone, etc.

- **Telecommunication Services**
  - Bearer Services
    - Circuit Switched
    - Packet Switched
  - Teleservices
    - Telephony 3,1 / 7 kHz
    - Videophony
    - Facsimile Group 3 / 4
    - Videotex
    - Telex
    - Teletex
  - Supplementary Services
    - MOU Priority 1
      - Calling Line Identification Presentation (CLIP)
      - Calling Line Identification Restriction (CLIR)
      - Direct Dialling In (DDI)
      - Multiple Subscriber Number (MSN)
      - Terminal Portability (TP)
    - MOU Priority 2
      - Connected Line Identification Presentation (COLP)
      - Connected Line Identification Restriction (COLR)
      - Advice of Charge (AOC)
      - Call Forwarding (CF)
      - Call Waiting (CW)
      - Call Hold (HOLD), etc.
    - Non-MOU
  - Terminal Services
    - Abbreviated Dialling
    - Call Log
    - Messaging - Answering Machine
  - Value Added Services
    - Stored Voice Services e.g. weather reports
    - Interactive Banking Services e.g. balance enquiries
    - Messaging Services e.g. Voice Mail

NOTE: This classification is used solely for the purposes of describing the proposed framework. It cannot be considered as definitive.

User Tasks are subdivided into the four major states that a terminal can exist in. These are Idle, when the terminal is switched off or is in standby (i.e. ready to receive incoming calls, and incidentally, to make outgoing calls). Set-up, which is a transitory state enabling the terminal to progress from Idle to Connection, or even from suspended Connection to new Connection. This is the most complex state as there are a number of possible tasks, e.g. Call set-up and Addressing, Call Accept (Incoming call), Payment, Identification (if necessary to confirm payment or the call originator), and Change (a generic facility to modify a parameter relevant to the set-up/connection). Connection, where the two or more parties may communicate by whichever media are available (Voice, Voice & Image, Data, etc.) Connection has a number of possible alternatives which can effect the procedures needed. These alternatives include, the number of parties (Single Party, Two Party, Multi-Party), the number of "lines" (one or both B-channels), and the alternative communication media (voice, voice plus data), etc. The final state is Termination. This is the second transitory state and progresses the call from Connection to Idle. No further subdivisions are proposed for this state.

User Tasks

- Idle
  - Establish default settings
- Set-up
  - Call Set-up, Addressing
  - Indicating Payment
  - Confirming Identification
  - Changing Settings
  - Incoming Call
- Connection
  - No. of Parties (Single Party, Two Party, Multi-Party)
  - No. of Lines (One or two 64 kbit channels)
  - Alternative Communication Media (Voice, Data, Image)
- Termination

The third axis is for Error Sources that can occur during a operational procedure. These sources include the Users A and B, Terminals A and B and the Network. To achieve a successful connection both users need to complete their procedures without an error. If an error is made at either end the connection may or may not progress, depending on the type of error and the error correction opportunities. At the same time it is possible that a fault may occur within either of the terminals, or any part of the networks involved, which prevents the connection. To simplify labelling in the framework, any limitation of the network or terminal which restricts the connection could be considered a fault. Therefore if Terminal B is engaged, a fault condition is indicated that the setup cannot be completed successfully. Similarly if the network is congested, or a route is unavailable a fault condition is indicated. For both of these situations it is possible that there are alternative procedures that the user can invoke which can attenuate the effect of the apparent fault, e.g. "Call Back when Free". These alternative procedures may be provided by the terminals or by parts of the network.

Error Sources

- None/ All OK
- User A Error
- Terminal A Faults
- Network Faults
- Terminal B Faults
- User B Errors

					User B Errors
				Terminal B Faults	
			Network Faults		
		Terminal A Faults			
	User A Errors				
All OK					
TASK	**Idle**	**Set Up**		**Connection**	**Termination**
	Incoming Call, Change	Call Set-up/Address, Payment, Identification, Change, Call Accept		Single Party, Two Party, Multi Party, Call in Progress	Call Terminate
Bearer Services Circuit Packet					
TeleServices Telephony 3,1 Telephony 7 Videophony Facsimile 3/4 Videotex Telex Teletex					
Supplementary Services MOU Level 1 MOU Level 2 Non MOU					
Terminal Services Abbreviated dialling Call log etc.					
Value Added Services Messaging, Stored Voice, etc.					

Figure 7: A three dimensional framework for user control procedures

4.4 Relationship to other User Interface Models

ETR 051 [4] describes a "Usability Component Model", which forms the starting point for their range of usability checklists. The essential elements of the model are three facets of the User to System Interface versus four facets of the User Capabilities. In detail these are:

User/System Interface
- The physical interface, e.g. the hardware shape, size, etc.
- The user input/output, e.g. the controls behaviour, range of operation, and the displays legibility, etc.
- The user interface dialogue, e.g. the sequence of displays and control operations.

User Capabilities
- The anthropometric, e.g. the size, shape, etc. of the parts of the user's body contacting the terminal.
- The motoric, e.g. the direction, speed and strength of movement, etc. necessary to activate the controls and to monitor the displays.
- The perceptual, e.g. the physiological and psychological response to the displays.
- The cognitive, e.g. the psychological and intellectual response to the operational sequence of controls and displays, and the comprehension of the displayed information.

The model uses a 3 x 4 matrix to demonstrate the interaction of these elements and to generate a checklist of usability components. This matrix is then repeated for each task domain that the user encounters. Typical task domains included in the model are: basic telephone set, business telephone set, interactive information service, and store and forward messaging (see figure 8).

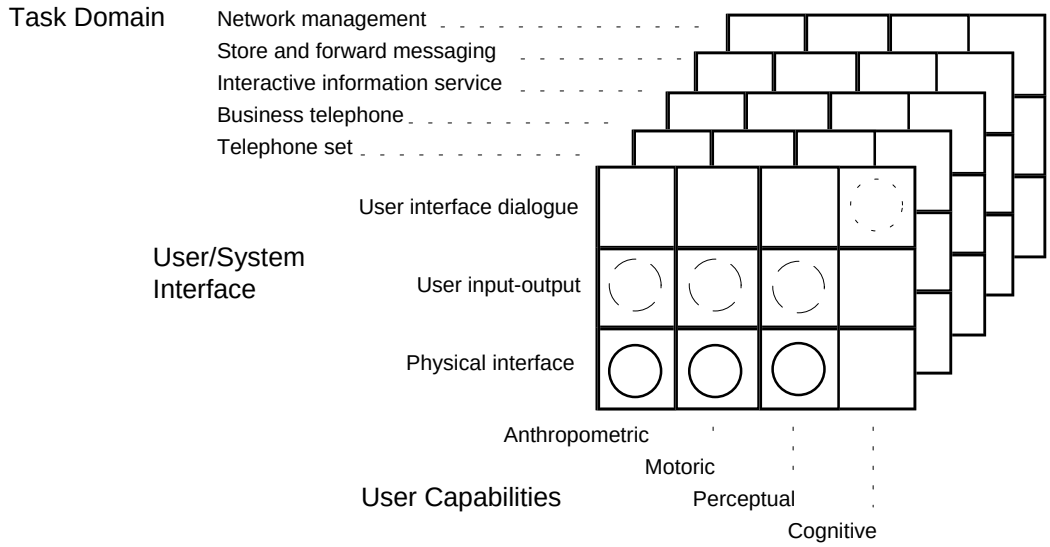

Figure 8: Usability Component Model (after ETR 051 [4])

The relationship between this Usability Component Model and the three layer model and the framework being proposed for user interaction and user procedures can be seen as different views of the same underlying concepts. The three layer model is used to structure thinking about peoples interaction with user procedures. The conceptual framework structures the telecommunications universe to elicit the range of possible user procedures. The Usability Component Model expands the possible implementations of a set of user procedures within a known task domain into hardware and software specifics. It then relates these systematically to peoples' known physical and mental capabilities.

There are also other similarities. The usability model lists a range of task domains, which is one taxonomy of possible user interface environments. The list of telecommunications services within the framework is simply another method of classification. The three facets of the user/system interface, also has parallels to the three layers of the three layer model.

5 Generic user control procedures

To elaborate the generic concept seven generic user control procedures have been developed to accommodate the basic requirements of making and answering a call. This is the essential facility across all types of terminals and teleservices. They fulfil part of the front top line of the generic framework. No attempt has been made to accommodate the possible failure and recovery procedures within this study. The procedures are based on both the general rules for user procedures and the interaction model. In particular at every control action there is the opportunity to continue or to exit from the procedure, and every sequence starts from an indication of the current state, and every control action is followed by an indication of the controls change of state and the effect on the terminal or network. The seven procedures covered are:

- Call Set-up;
- Incoming Call;
- Payment;
- Identification;
- Change;
- Call in Progress;
- Termination.

The procedures are described using standard SDL diagrams (in accordance with ITU-T Recommendation Z.100 [1]. A brief description of the SDL flowchart elements is given in figure 9.

Call Set-up - starting from idle this procedure enables the user to initiate a call (START), select a teleservice, and input an address in any order. Single teleservice terminals (e.g. telephones) will, of course, omit the teleservice change option. The procedure layout emphasizes the principal of Indication - Control Action - Indication, but it should be remembered that two or more indications may be synonymous. For example, the Dial Tone is both an indication that the call has been initiated and a prompt for a new address. Similarly, a Repeat Last Number control may simultaneously Start a call, Select a teleservice and Input an address. Call set-up also accommodates terminals which require external payments, by what ever means, by reference to the generic payment procedure (see figure 10, "Generic call set-up").

Incoming Call - starts from a call in the network and attempts to accommodate the full range of options, including: the network supplementary service; Call Waiting; the possibility of other compatible ISDN terminals at the same access point; the possibility of a terminal Call Waiting facility; the possibility of a mismatch between the incoming call and the terminals default teleservice. This range of options makes this procedure the most complex of the seven (see figure 11, "Generic incoming call").

Payment - starts from the principle that an external payment requirement has been identified by the terminal or the network. This is indicated to the user as a prompt that payment is required. The procedure attempts to accommodate all current methods of payment: coins or tokens, prepaid card or credit card, or credit accounts. The possibility that identification may also be necessary to confirm a payment is also covered (see figure 12, "Generic payment").

Identification - starts from the principle that an identification requirement has been detected by the terminal or the network. This is indicated to the user as a prompt that identification is required. The procedure attempts to accommodate a range of identification methods: plain, magnetic or smart card; physical key; keyed data (passcode or word); or electronic module (see figure 13, "Generic identification").

Change - starts from the user identifying that they wish to initiate a change in state of the terminal or the network (e.g. change teleservice), or in response to a prompt indicating a choice the user needs to make in respect of the current setting of the terminal or the network. The procedure attempts to accommodate the possibilities that the change may invoke, e.g. a need for identification, or that more data may be required by the terminal or network to complete the change requested (see figure 14, "Generic change").

Call in Progress - to complete the set of procedures, Generic call in progress was needed to enable continuity with the other procedures (see figure 15, "Generic call in progress").

Terminate - starts from a call in progress and assumes that the user is initiating the termination. The procedure also accommodates the possibilities of more than one call being in progress (see figure 16, "Generic terminate").

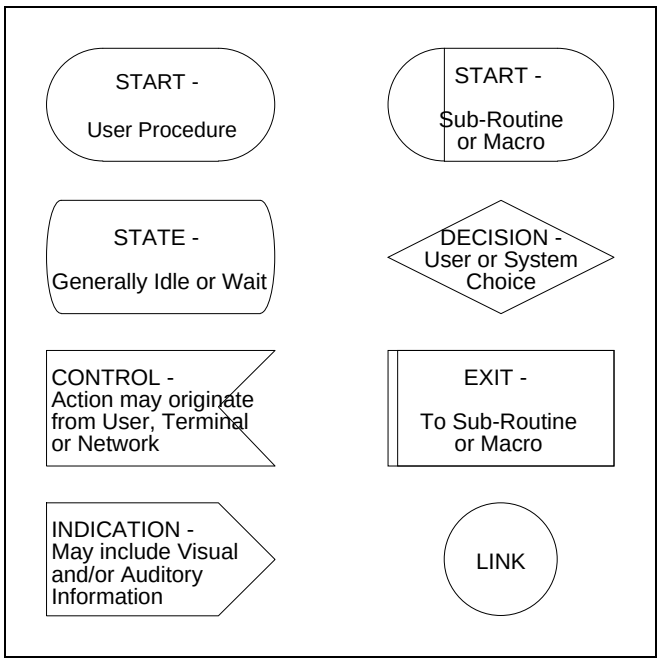

Figure 9: SDL diagram symbols used in the generic user procedures

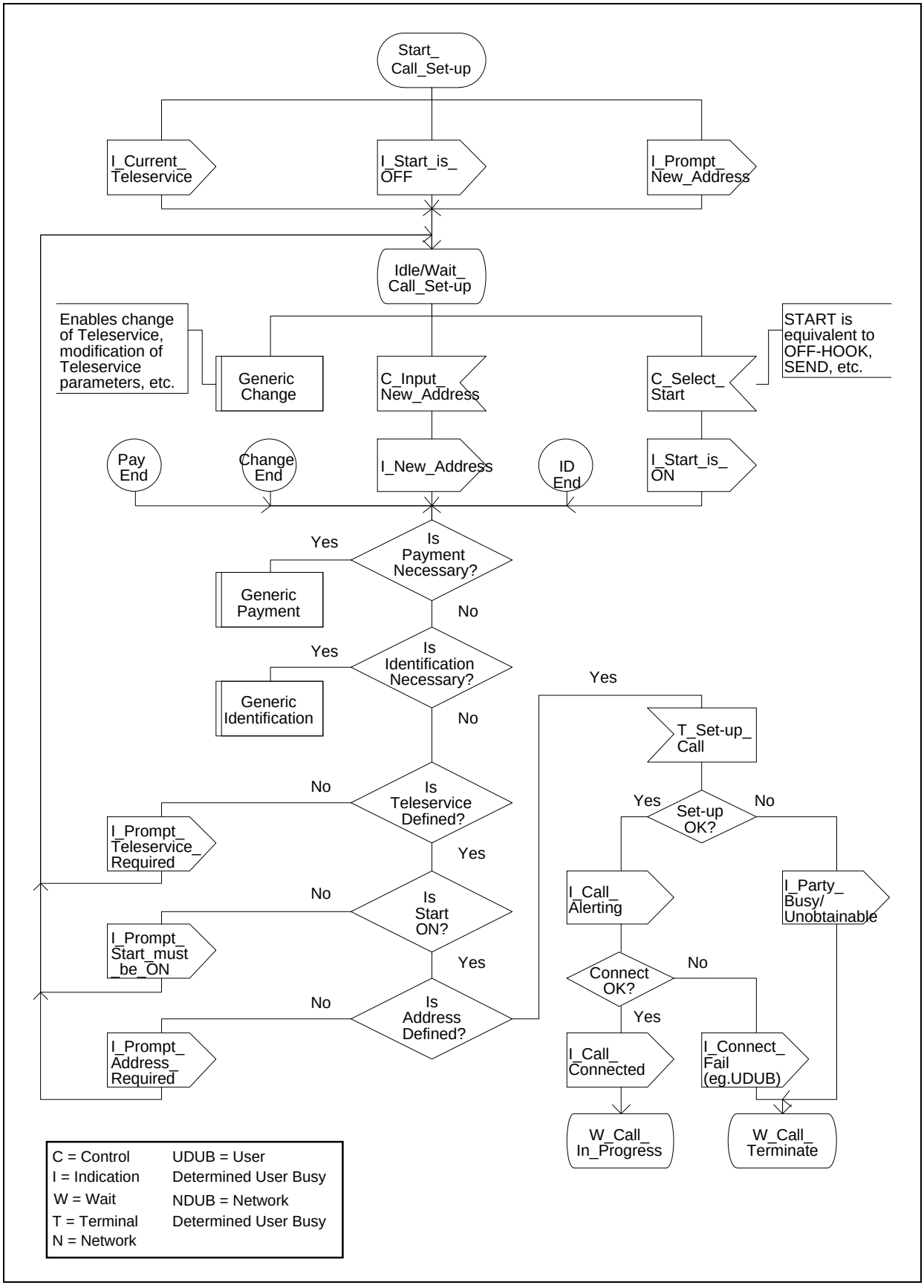

Figure 10: Generic call set-up

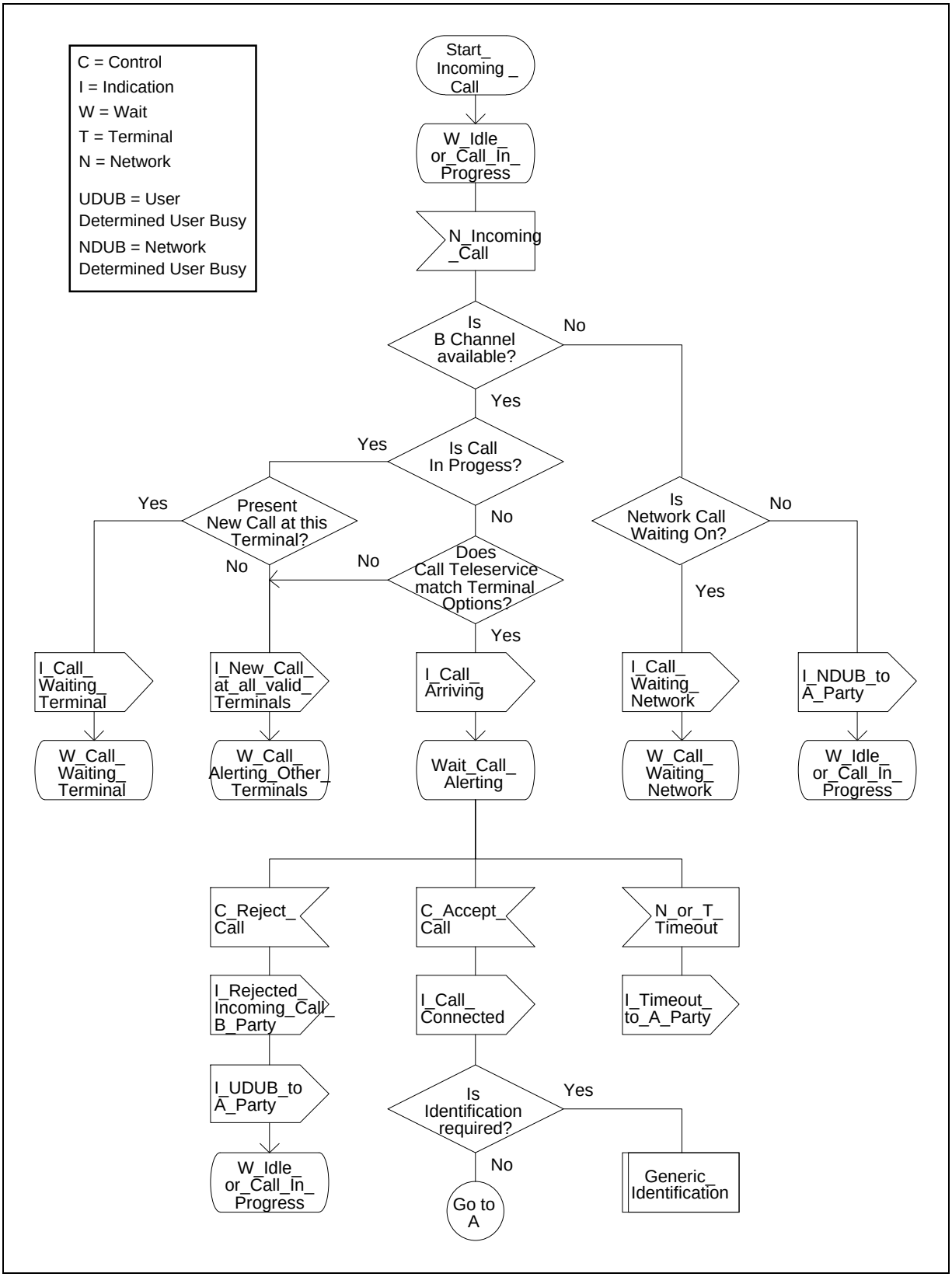

Figure 11: Generic incoming call

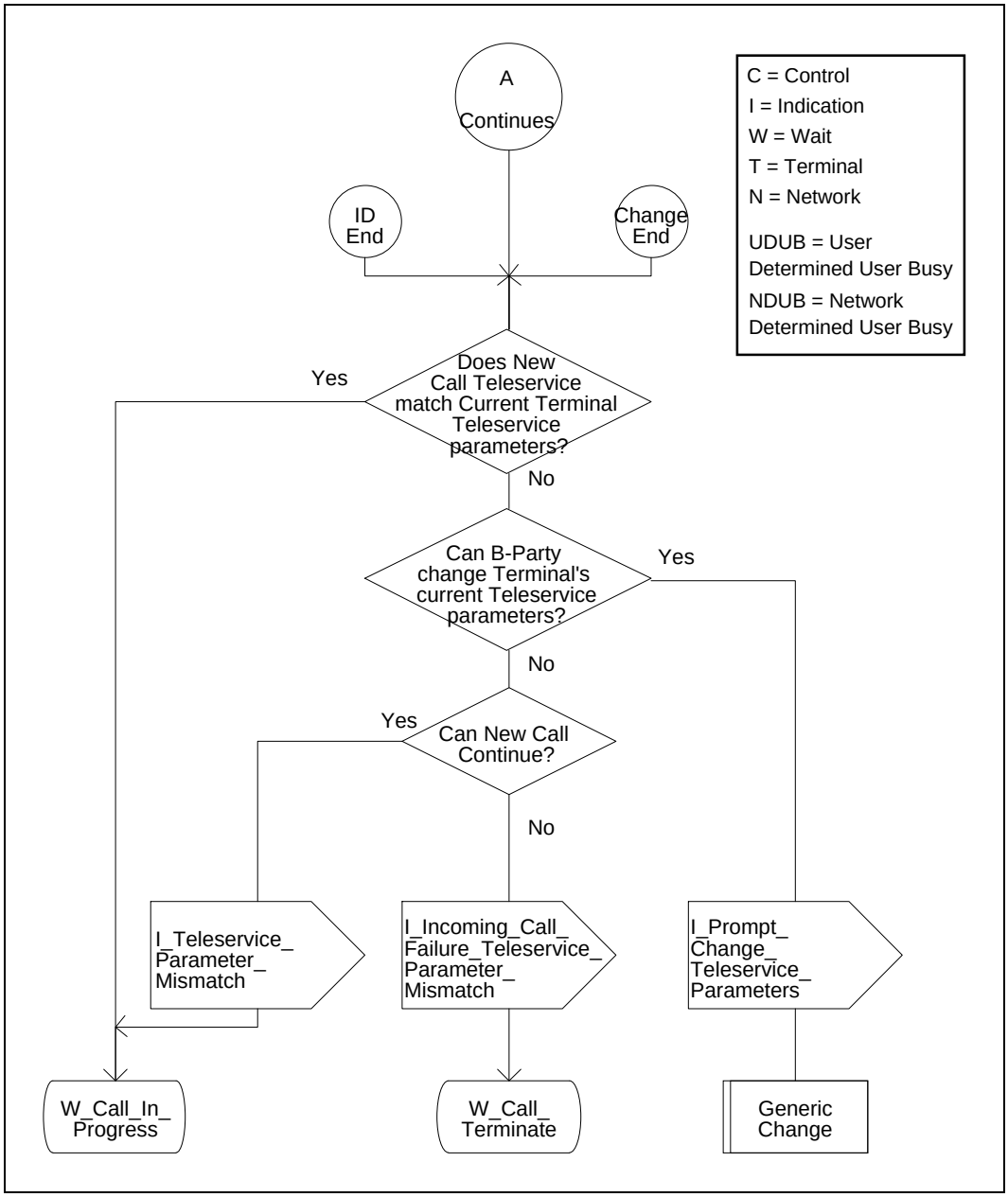

Figure 11 (concluded): Generic incoming call

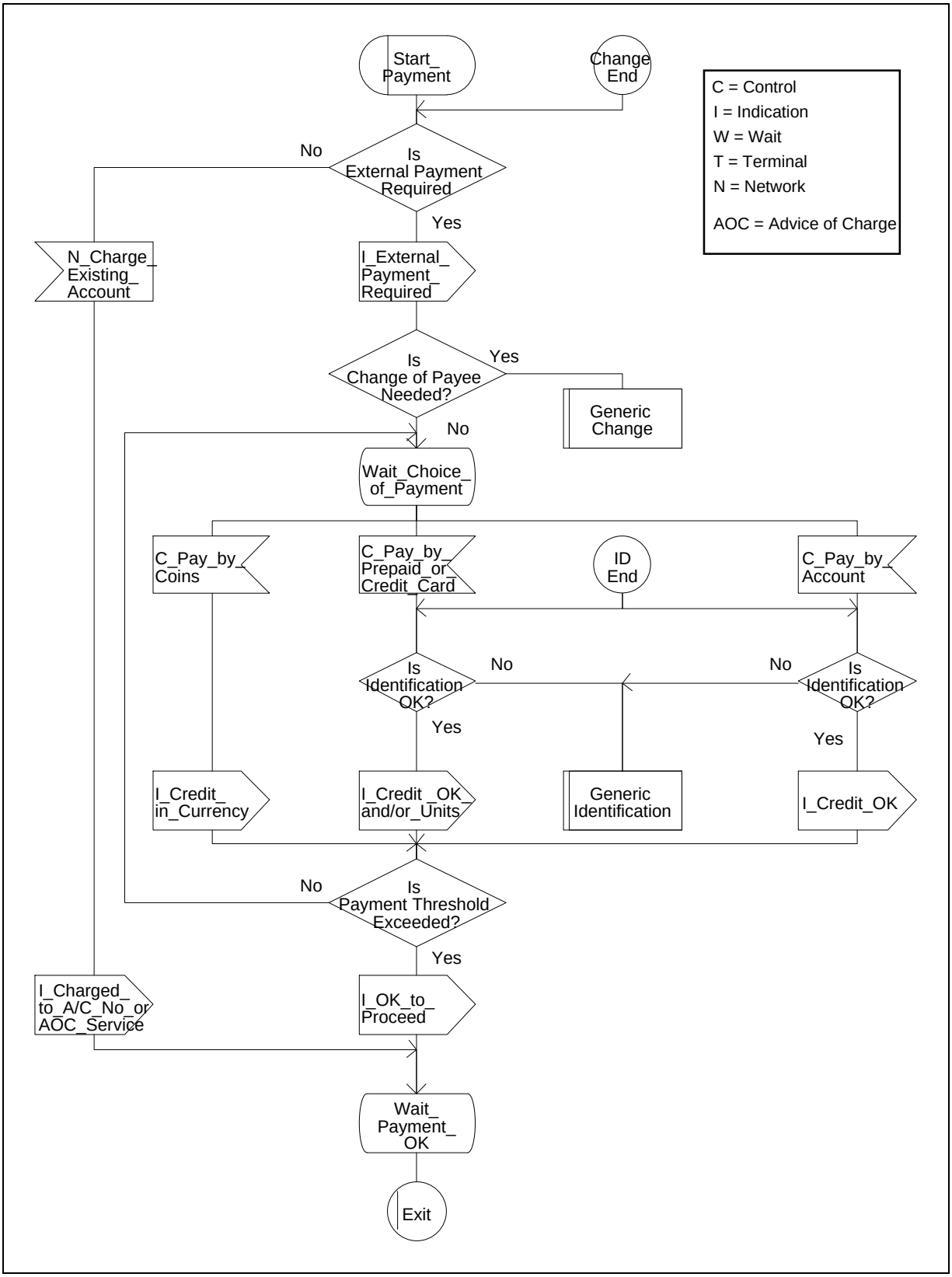

Figure 12: Generic payment

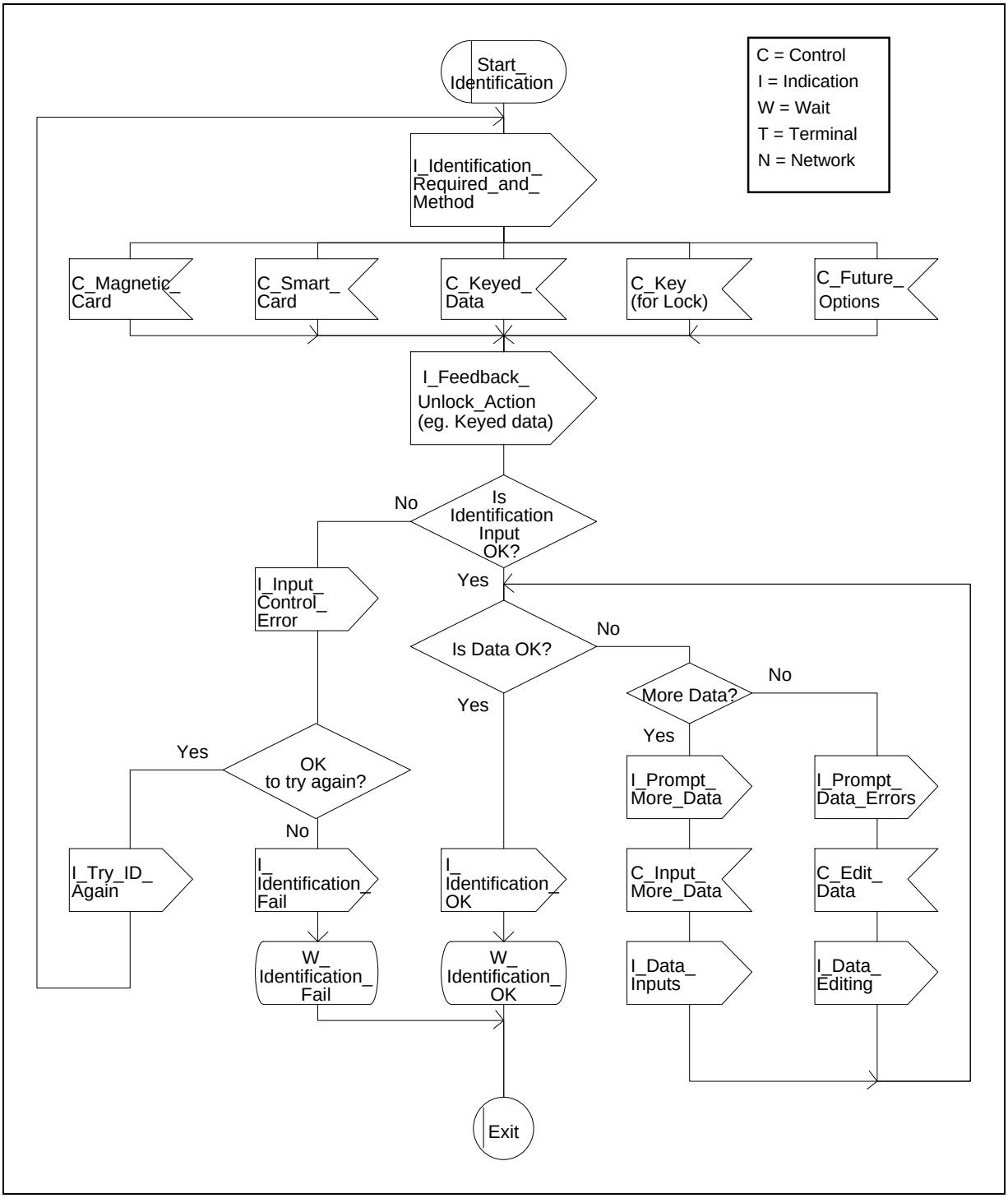

Figure 13: Generic identification

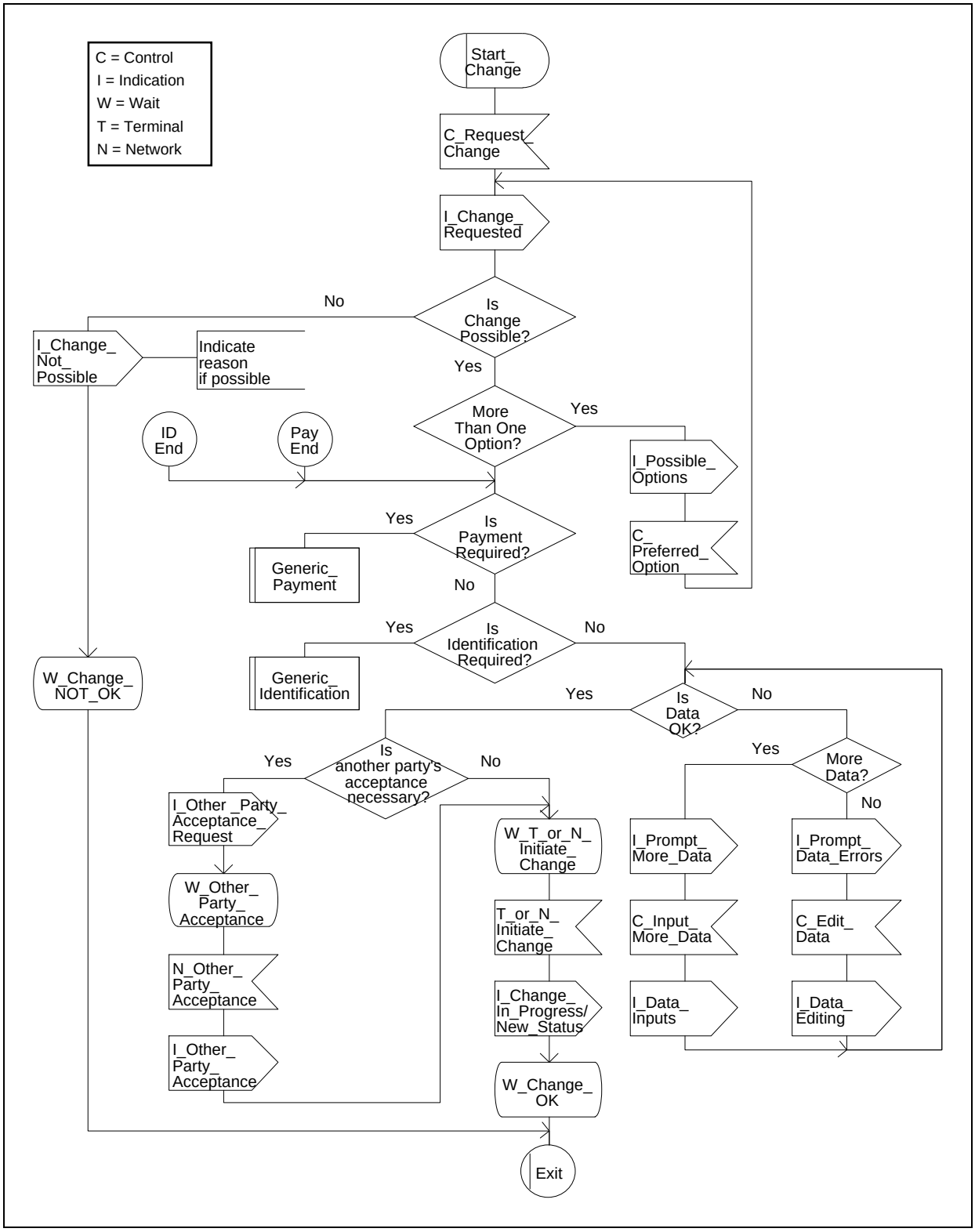

Figure 14: Generic change

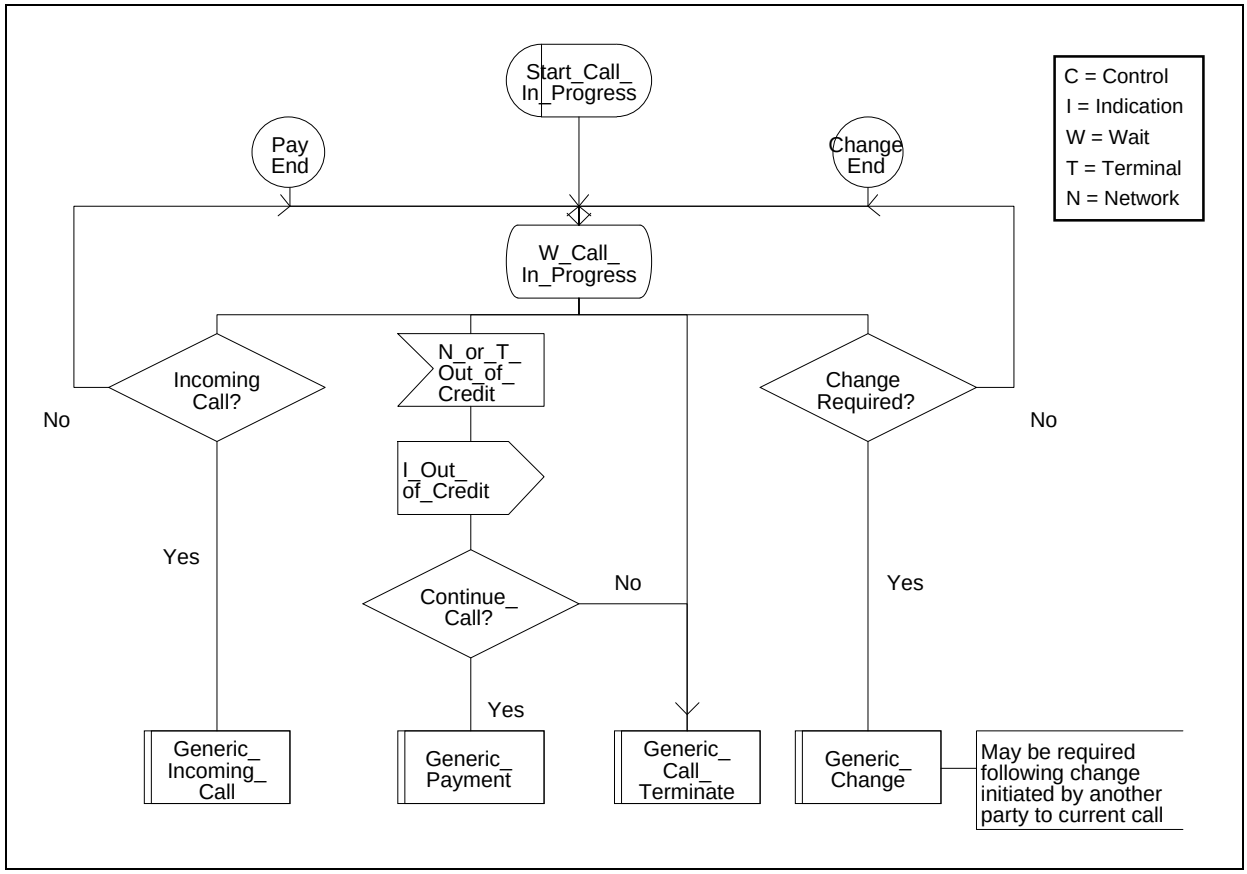

Figure 15: Generic call in progress

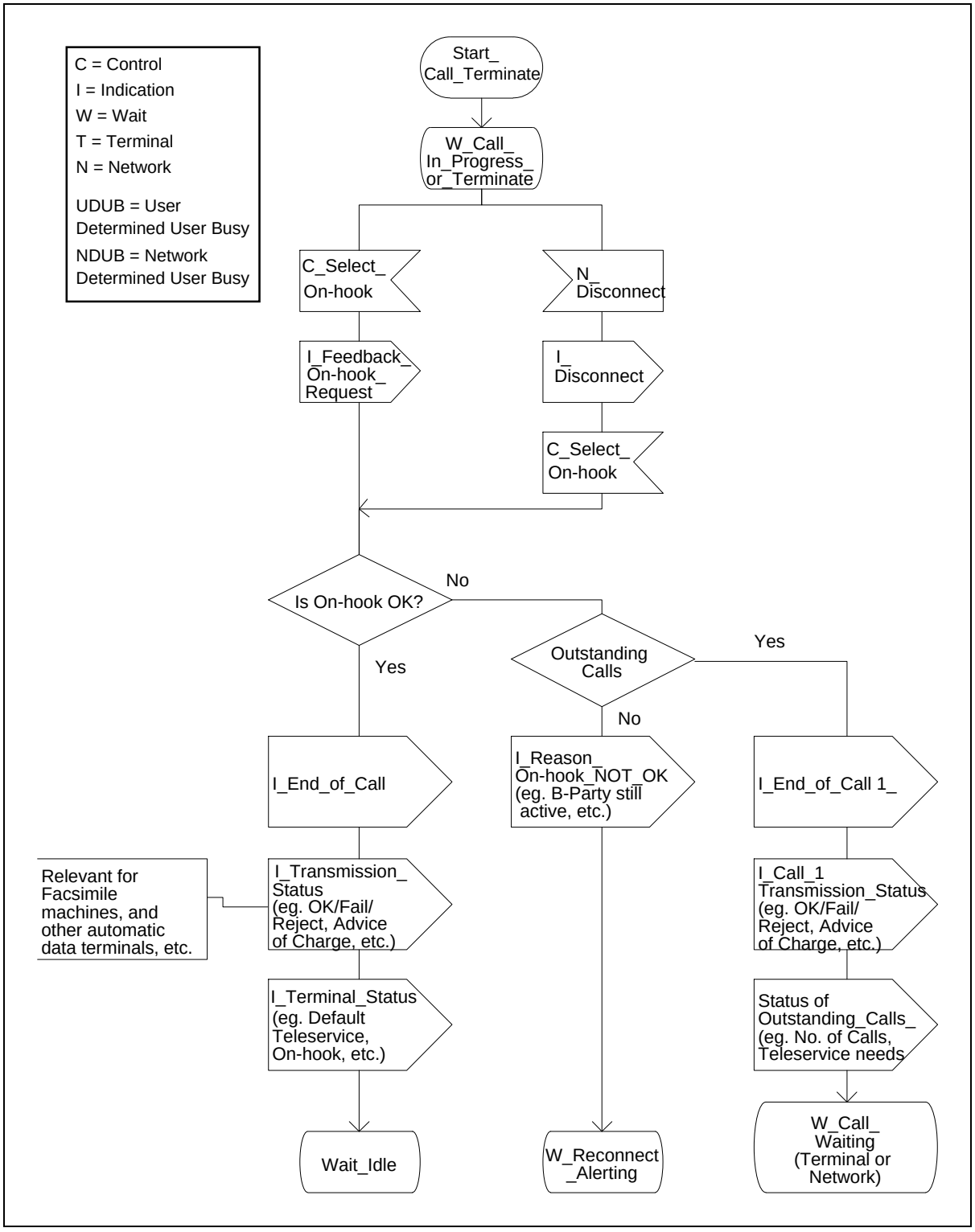

Figure 16: Generic call terminate

6 Conclusions and Recommendations

6.1 Conclusions

The conclusions of this ETR are:

- that evidence gathered confirms that there is a reluctance to standardize even basic user control procedures. The activity is seen, not as a way to expand the accessibility of telecommunication services and facilities, but rather as a restriction on manufacturers and service providers which impacts the creative development of their products and limits their competitive margins. There is a significant attitude change required to ensure that a minimum level of usability can be achieved within and between telecommunication services by the acceptance of well researched minimum user control procedures. The expected format of such procedures would define a minimum sequence of indications and controls necessary to enable the user to make use of a service. The procedures would not define the format or substance of the controls or indications and would not preclude other alternative procedures from being provided, but they would ensure that a user could access and control a service irrespective of the terminal or network being used.

- that evidence gathered showed that where user procedures were being standardized there were inconsistencies between the different standards bodies requirements and recommendations, even when they were specifying the same thing (but perhaps for slightly different applications), e.g. CCITT Recommendation E.131 [9], CEPT Recommendations T/CAC 02 E [5], T/CAC S 10 E [6], T/CAC S 10.7 E, annex 0.2 [7] and ETS 300 511 (GSM 02.30) [8]. Specifically, the existing stimulus and functional protocols used for controlling supplementary services within the PSTN, ISDN and GSM are incompatible.

- that evidence gathered showed there was no clear perspective within network providers or manufacturers on who was responsible for defining the user procedures for network services accessed through the terminal. The evidence also suggests that there is no consistent policy across products and services, on who is responsible, nor on the methodology or descriptive tool for defining a user control procedures.

- that a generic concept has been developed which concentrates principally on user interaction within user control procedures, rather than just user procedures. The concept explores the potential of a three layer model and derives a general principle and a set of twelve general rules. The concept is concluded with a three dimensional generic framework that offers an opportunity for structuring the work required to develop user procedures with ETSI TC-HF and other committees.

- that the generic concept, principle and rules have been elaborated into a set of seven generic user procedures, which fit into part of the generic framework.

- that the generic concept and the generic framework relate well to other conceptual models.

6.2 Recommendations

The following recommendations are made:

1) ETSI, and TC-HF in particular, should promote the validity of standardization activity within the area of user control procedures, that where appropriate these should be developed to be consistent with the generic concept, principle and rules and coherent with the generic framework and with other similarly prepared user procedures.

2) That any development within ETSI of user control procedures or facilities which enable user control procedures should, where appropriate, comply with the generic concept, principle and rules.

3) That the opportunity be made to develop user control procedures for videotelephony which comply with the generic concept and general rules.

   NOTE 1: Work is being carried out by TC-HF under work item DI/HF-01018 ("End user procedures in basic call, point-to-point connection, for ISDN videotelephones").

4) That detailed work is started on the user procedures necessary to support supplementary and other telecommunication services and the need for consistency between common services provided by both the terminal and the network. There is particular concern about the potential confusion of the users in operating Call Hold and the other multiparty services at the terminal and network levels. This further work should also take the opportunity to examine more broadly the models users have of telecommunications.

NOTE 2: Elements of this work is being performed by TC-HF under work item DE/HF-01017 ("Minimum Man Machine Interface (MMI) for the access and control of public network based telecommunication services").

Annex A: Bibliography

The following documents were used as source material in the preparation of this ETR but have not been explicitly referenced:

1) CCITT Recommendation E.132 (1988): "Standardization of elements of control procedures for supplementary services".

2) CCITT Recommendation E.133 (1988): "Operating procedures for cardphones".

3) ITU-T Recommendation E.161 (1993): "Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network".

4) CCITT Recommendation E.182 (1988): "Application of tones and recorded announcements in telephone services".

5) CCITT Recommendation E.183 (1988): "Guiding principles for telephone announcements".

6) CCITT Recommendation E.184 (1988): "Indications to users of ISDN terminals".

7) CCITT Recommendation E.330 (1988): "User control of ISDN-supported services".

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

9) CCITT Recommendation I.121 (1991): "Broadband aspects of ISDN".

10) CCITT Recommendation I.241 (1988): "Teleservices supported by an ISDN".

11) CCITT Recommendation I.250 (1988): "Definition of supplementary services".

12) CCITT Recommendation I.251 (1988): "Number identification supplementary services".

13) CCITT Recommendation I.252 (1988): "Call offering supplementary services".

14) CCITT Recommendation I.253 (1988): "Call completion supplementary services".

15) CCITT Recommendation I.254 (1988): "Multiparty supplementary services".

16) CCITT Recommendation I.255 (1988): "Community of interest supplementary services".

17) CCITT Recommendation I.256 (1988): "Charging supplementary services".

18) CCITT Recommendation I.257 (1988): "Additional information transfer".

19) ITU-T Recommendation Q.931 (1993): "Digital subscriber Signalling System No. one (DSS1) - ISDN user-network interface layer 3 specification for basic call control".

20) ITU-T Recommendation Q.932 (1993): "Digital subscriber Signalling System No. one (DSS1) - Generic procedures for the control of ISDN supplementary services".

21) CCITT/ITU-T Recommendations Z.301-Z.341 (1988): "Man-Machine language".

22) Deutsche Bundespost FTZ 1 TR 3: "Technische Forderungen an digitale Endgerate mit So-Schnittstelle", (Terminals connected to the So-interface).

23) Deutsche Bundespost FTZ 121 TR 10: "Bedienprozeduren fur Bildtel." (User procedures for Videotelephones).

24) ETR 096 (1993): "Human Factors (HF); Phone Based Interfaces (PBI), Human factors guidelines for the design of minimum phone-based user interface to computer services".

25) ETS 300 050 (1991): "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service, Service description".

26) ETS 300 053: "Integrated Services Digital Network (ISDN); Terminal Portability (TP) supplementary service, Service description".

27) ETS 300 056: "Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service, Service description".

28) ETS 300 059: "Integrated Services Digital Network (ISDN); Subaddressing (SUB) supplementary service, Service description".

29) ETS 300 062: "Integrated Services Digital Network (ISDN); Direct Dialling In (DDI) supplementary service, Service description".

30) ETS 300 089: "Integrated Services Digital Network (ISDN); Calling Line Identification Presentation (CLIP) supplementary service, Service description".

31) ETS 300 090 "Integrated Services Digital Network (ISDN); Calling Line Identification Restriction (CLIR) supplementary service, Service description".

32) ETS 300 094: "Integrated Services Digital Network (ISDN); Connected Line Identification Presentation (COLP) supplementary service, Service description".

33) ETS 300 095: "Integrated Services Digital Network (ISDN); Connected Line Identification Restriction (COLR) supplementary service, Service description".

34) ETS 300 111: "Integrated Services Digital Network (ISDN); Telephony 3,1 kHz teleservice, Service description".

35) ETS 300 128: "Integrated Services Digital Network (ISDN); Malicious Call Identification (MCID) supplementary service, Service description".

36) ETS 300 136: "Integrated Services Digital Network (ISDN); Closed User Group (CUG) supplementary service, Service description".

37) ETS 300 139: "Integrated Services Digital Network (ISDN); Call Hold (HOLD) supplementary service, Service description".

38) ETS 300 143: "Integrated Services Digital Network (ISDN); Audiovisual services, Inband signalling procedures for audiovisual terminals using digital channels up to 2 048 kbit/s".

39) ETS 300 144: "Integrated Services Digital Network (ISDN); Audiovisual services, Frame structure for a 64 kbit/s to 1 920 kbit/s channel and associated syntax for inband signalling".

40) ETS 300 145: "Integrated Services Digital Network (ISDN); Audiovisual services, Videotelephone systems and terminal equipment operating on one or two 64 kbit/s channels".

41) ETS 300 164: "Integrated Services Digital Network (ISDN); Meet-Me Conference (MMC) supplementary service, Service description".

42) ETS 300 178: "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at Call Set-up (AOC-S) supplementary service, Service description".

43) ETS 300 179: "Integrated Services Digital Network (ISDN); Advice of Charge: charging information during the Call (AOC-D) supplementary service, Service description".

44) ETS 300 180: "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at the end of the call (AOC-E) supplementary service, Service description".

45) ETS 300 183: "Integrated Services Digital Network (ISDN); Conference call, add on (CONF) supplementary service, Service description".

46) ETS 300 186: "Integrated Services Digital Network (ISDN); Three Party (3PTY) supplementary service, Service description".

47) ETS 300 199: "Integrated Services Digital Network (ISDN); Call Forwarding Busy (CFB) supplementary service, Service description".

48) ETS 300 200: "Integrated Services Digital Network (ISDN); Call Forwarding Unconditional (CFU) supplementary service, Service description".

49) ETS 300 201: "Integrated Services Digital Network (ISDN); Call Forwarding No Reply (CFNR) supplementary service, Service description".

50) ETS 300 202: "Integrated Services Digital Network (ISDN); Call Deflection (CD) supplementary service, Service description".

51) ETS 300 208: "Integrated Services Digital Network (ISDN); Freephone (FPH) supplementary service, Service description".

52) ETS 300 263: "Integrated Services Digital Network (ISDN); Telephony 7 kHz teleservice, Service description".

53) ETS 300 264: "Integrated Services Digital Network (ISDN); Videotelephony teleservice, Service description".

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55) ETS 300 284: "Integrated Services Digital Network (ISDN); User-to-User Signalling (UUS) supplementary service, Service description".

56) ETS 300 357: "Integrated Services Digital Network (ISDN); Completion of Calls to Busy Subscriber (CCBS) supplementary service, Service description".

57) ETS 300 367: "Integrated Services Digital Network (ISDN); Explicit Call Transfer (ECT) supplementary service, Service description".

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History

Document history	
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