Draft EN 301 061-1 V1.1.1 (1997-08)

European Standard (Telecommunications series)

Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Generic functional protocol for the support of supplementary services for Virtual Private Network (VPN) applications; Part 1: Protocol specification

European Telecommunications Standards Institute

Reference
DEN/SPS-05110-1 (9to90ico.PDF)

Keywords
DSS1, generic, ISDN, supplementary service, VPN

ETSI Secretariat

Postal address
F-06921 Sophia Antipolis Cedex - FRANCE

Office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

X.400
c= fr; a=atlas; p=etsi; s=secretariat

Internet
secretariat@etsi.fr
http://www.etsi.fr

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Foreword

This draft European Standard (Telecommunications series) has been produced by ETSI Technical Committee Signalling Protocols and Switching (SPS), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure (TAP).

The present document is part 1 of a multi-part European Standard (Telecommunications series) covering the Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Generic functional protocol for the support of supplementary services for Virtual Private Network (VPN) applications, as identified below:

Part 1: "Protocol specification";

Part 2: "Protocol Implementation Conformance Statement (PICS) proforma specification";

Part 3: "Test Suite Structure and Test Purposes (TSS&TP), user";

Part 4: "Abstract Test Suite (ATS), user";

Part 5: "TSS&TP, network";

Part 6: "ATS, network".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document specifies the generic functional protocol for the pan-European Integrated Services Digital Network (ISDN) applicable at the "b service entry point" (as defined in EN 301 060-1 [3]). It is part of the Digital Subscriber Signalling System No. one (DSS1) protocol.

The generic functional protocol is based on the Facility information element and the FACILITY message, as well as on other specific functional messages. The protocol is symmetrical, and it is applicable to both basic and primary rate interfaces.

The generic functional protocol defined in the present document provides the means to exchange signalling information for the control of supplementary services over a Virtual Private Network (VPN). It does not by itself control any supplementary service but rather provides generic services to specific supplementary service control entities.

The application of the present document to individual supplementary services is outside the scope of the present document and is defined in those standards which specify the individual supplementary services.

Further part(s) of the present document specify the method of testing required to identify conformance to the present document.

The present document is applicable only to point-to-point access configurations.

NOTE 1: The exchange of signalling information relating to the VPN "b" service entry point is distinguished from the exchange of signalling information that is used to access public network services at the T reference point. The generic functional protocol applicable in a public network context is supported in accordance with the requirements of EN 300 196-1 [1]. The generic functional protocol specifically applicable in a VPN context is supported in accordance with this standard. The requirements have been defined such that both contexts can coexist on the same access, and this is expected to be a typical implementation. There is no requirement that when this standard is implemented, the exchange of signalling information relating to the T reference point also need to be implemented on the same access. Where both contexts are implemented, the access resources are common to both contexts.

NOTE 2: Where both contexts are supported on the same access, a service provider may support supplementary services applicable for public network calls within a VPN context. In this case the applicability of the individual public network supplementary services to a call with VPN context is beyond the scope of this standard.

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] EN 300 196-1 (1997): "Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[2] EN 300 403-1 (1997): "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.911 (1993), modified]".

[3] EN 301 060-1 (date of first publication): "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Basic call applications enhancement at the "b" service entry point for Virtual Private Network (VPN) applications; Part 1: Protocol specification".

[4] ETS 300 402-2 (1995): "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 2: General protocol specification [ITU-T Recommendation Q.921 (1993), modified]".

[5] ISO/IEC 11582 (1995): "Information technology - Telecommunication and information exchange between systems - Private Integrated Services Network - Generic functional protocol for the support of supplementary services - Inter-exchange signalling procedures and protocol".

[6] ITU-T Recommendation X.219 (1988): "Remote operations: Model, notation and service definition".

[7] ITU-T Recommendation X.229 (1988): "Remote operations: Protocol specification".

[8] ETS 300 415 (1996): "Private Integrated Services Network (PISN); Terms and definitions".

[9] ISO/IEC 15056 (1997): "Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Inter-exchange signalling protocol - Transit counter additional network feature".

3 Definitions and abbreviations

3.1 Definitions

Clause 3 of EN 300 196-1 [1] shall apply with the following addition:

Corporate telecommunication Network (CN): Sets of equipment (Customer Premises Equipment or Customer Premises Network) which are located at geographically dispersed locations and are interconnected to provide networking services to a defined group of users.

NOTE 1: The ownership of the equipment is not relevant to this definition.

NOTE 2: In the present document, even equipment which is not geographically dispersed (e.g. a single Private Integrated Services Network eXchange (PINX) or Centrex provided services to users at a single location) may form a CN.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BC	Bearer Capability
CN	Corporate telecommunication Network
DSS1	Digital Subscriber Signalling System No. one
GFT	Generic Functional Transport
ISDN	Integrated Services Digital Network
NCICS	Networked Call Independent, Connection-oriented Signalling
NFE	Network Facility Extension
PINX	Private Integrated Services Network eXchange
PSS1	Private Signalling System No. one
VPN	Virtual Private Network

4 Coexistence of generic protocols for the control of supplementary services

4.1 Support of various generic protocols

Subclause 5.1 of EN 300 196-1 [1] shall apply.

4.2 Coexistence of generic protocols

Subclause 5.2 of EN 300 196-1 [1] shall apply.

In addition, the protocol described in the present document incorporates the functionality of the generic functional protocol described in EN 300 196-1 [1].

4.3 Arrangements by which coexistence of protocols may be supported by a network

Subclause 5.3 of EN 300 196-1 [1] shall apply.

5 General principles applied for the functional control of supplementary services

5.1 Introduction

This subclause specifies the general principles applied for the functional control of supplementary services at the "b service entry point" (as defined in EN 301 060-1 [3]). The generic protocol utilizes functions and services provided by EN 300 403-1 [2] basic call procedures, as extended by EN 301 060-1 [3], and the functions of the data link layer as defined in ETS 300 402-2 [4].

5.2 Scope of the procedures

The procedures defined in the present document specify the basic methodology for the control (e.g. invocation, notification, deactivation, etc.) of supplementary services. The procedures are independent of whether or not the user-network interface is at a basic or primary rate access.

5.3 Categories of procedures

Two categories of procedures are defined.

The first category deals with the control of supplementary services in a public network context. For this category, subclause 6.3 of EN 300 196-1 [1] shall apply.

The second category deals with the control of supplementary services in a VPN context.

The entity that establishes a signalling relation shall indicate by means of the VPN indicator information element in which context the signalling information is to be interpreted. The VPN indicator information element and the associated procedures are described in EN 301 060-1 [3] and in subclause 7.1.3 of the present document.

5.4 VPN services in the context of CN

See subclause 5.1 of EN 301 060-1 [3].

6 Control of supplementary services using the separate message approach

These procedures shall be used only in a public network context. Clause 7 of EN 300 196-1 [1] shall apply.

7 Control of supplementary services using the common information element approach

7.1 General

7.1.1 Introduction

In the common information element approach, the Facility information element is used to transport information for the control of supplementary services, conveying components as application-oriented elements complemented by the necessary procedures for operations and transport mechanisms. Operations and transport mechanisms may either be related to a connection or may be used independently of a connection.

The common information element approach is modelled as remote operations as specified in ITU-T Recommendations X.219 [6] and X.229 [7]. According to this model, one entity requests that a particular operation be performed whilst the responding entity attempts to perform the operation and responds to the invoking entity. Therefore an operation of the common information element approach is regarded as a request/reply interaction, supported by the application function and carried out within the context of an application association (for definitions see subclause 3.2).

An error is used to report the unsuccessful outcome of an operation. For each operation the appropriate errors, if required, need to be indicated.

7.1.2 Scope of the procedures

Subclause 8.1.2 of EN 300 196-1 [1] shall apply.

7.1.3 Distinction between public network and VPN context

An indication is necessary to distinguish between a public network or a VPN context.

If an entity sends a message that establishes a call reference in a VPN context, it shall include a VPN indicator information element in this message. If an entity sends such a message in a public network context, it shall not include a VPN indicator information element in this message.

If an entity receives a message that establishes a call reference, and this message does not contain a VPN indicator information element, it shall apply the procedures for signalling in a public network context for all messages that use this call reference.

If an entity receives such a message containing a VPN indicator information element, it shall apply the procedures for signalling in a VPN context for all messages that use this call reference.

If an entity receives a FACILITY message with the dummy call reference, and this message does not contain a VPN indicator information element, it shall apply the procedures for signalling in a public network context.

If an entity receives a FACILITY message with the dummy call reference, and this message contains a VPN indicator information element, it shall apply the procedures for signalling in a VPN context.

NOTE: The present document does not specify the use of the dummy call reference in the FACILITY message. The receipt of a FACILITY message with the dummy call reference in a VPN context is an error, and error handling procedures are applied.

7.2 Procedures applicable for signalling in a VPN context

7.2.1 Transport of components

7.2.1.1 Bearer related transport mechanism

7.2.1.1.1 Protocol control requirements

This subclause defines the transport of components using the messages for the establishment and the clearing of calls. The procedures for basic call control are described in EN 300 403-1 [2], clause 5, and in EN 301 060-1 [3] . These procedures are not influenced by the components carried. Bearer-related transport procedures and operations shall follow the specified procedures and transport capabilities of bearer connections according to EN 300 403-1 [2] and EN 301 060-1 [3]. The SETUP message shall contain the VPN indicator information element.

For bearer-related transport of components the call state of the bearer connection must be in a state (or about to enter a state) other than the Null state (U0, N0). For transport any call control message as defined in EN 300 403-1 [2], subclause 3.1, may be used to carry the components in a Facility information element. These messages shall use the call reference of the bearer connection.

NOTE: If the call establishment request has not reached the addressed PINX, the component included in the FACILITY message may not reach its intended destination. There is no requirement for any entity to avoid this by storing the information.

For general rules, format and coding of call reference values, subclause 4.3 of EN 300 403-1 [2] is applicable.

The call reference provides the means to correlate messages belonging to the same signalling transaction of a connection. When a supplementary service affects more than one connection, different call references are used to identify each connection individually. This implies the use of different messages in order to manage each connection separately.

The implicit call-control association provided by an EN 300 403-1 [2] call reference shall always be cleared when a connection is released.

The Cause information element shall only be used to report EN 300 403-1 [2] errors outside the component portion of the Facility information element (octets 1 - 3). When no EN 300 403-1 [2] protocol error is found, the Cause information element shall convey cause #31, "normal unspecified". For protocol errors in the component portion of the Facility information element (octets 4, etc) see subclauses 7.2.1.1.2 and 9.1.

7.2.1.1.2 Generic Functional Transport (GFT)-Control requirements

Subclause 7.1.2 of ISO/IEC 11582 [5] shall apply.

NOTE: These requirements only apply to PINX entites that terminate the GFT-Control protocol. Otherwise, the Facility information element will be transferred to the next entity regardless of the contents of the destination Entity element in the Network Facility Extension (NFE). Some nodal entities may not terminate the GFT-Control protocol, while providing the minimum Transit PINX functions required.

7.2.1.2 Connection-oriented bearer-independent transport mechanism

7.2.1.2.1 Protocol control requirements

7.2.1.2.1.1 Connection establishment at the originating interface

Before these procedures are invoked, a reliable data link connection needs to be established between the user (TE/NT2) and the network. All layer 3 messages shall be sent to the data link layer using a DL-DATA request primitive. The data link services described in EN 300 402-2 [4] are assumed.

7.2.1.2.1.1.1 Connection request

A user initiates Networked Call Independent, Connection-oriented Signalling (NCICS) connection establishment by transferring a call independent SETUP message across the user-network interface. Following the transmission of the SETUP message, the connection shall be considered by the user to be in the call initiated state. The SETUP message shall always contain a call reference, selected according to the procedures given in subclause 4.3 of EN 300 403-1 [2]. In selecting a call reference, the dummy call reference value shall not be used.

Furthermore the SETUP message shall contain the VPN indicator information element and all of the information (i.e. address and facility requests) necessary for connection establishment. Refer to subclause 11.1.2.7 for the contents of the SETUP message.

The user shall start timer T303 upon transmission of the SETUP message and enter the Call Initiated state. If the user does not receive a response to the SETUP message prior to the expiry of timer T303, the user shall retransmit the SETUP message and retransmit timer T303. If the user does not receive any response to the retransmitted SETUP message prior to the expiration of timer T303, then the user shall send a RELEASE COMPLETE message to the network with cause No. 102, recovery on timer expiry and internally clear the NCICS connection.

On receipt of a call independent SETUP message, the network shall:

- if the request is valid and can be processed, follow the procedures of subclause 7.2.1.2.1.1.3;
- if the request is invalid or cannot be accepted, follow the procedures of subclause 7.2.1.2.1.1.2.

The FACILITY message shall be exchanged only once the NCICS connection has reached the active state.

7.2.1.2.1.1.2 Invalid connection information

If the NCICS request is invalid or cannot be accepted, the network shall return a RELEASE COMPLETE message, release the call reference, and remain in the Null state. The RELEASE COMPLETE message shall contain an appropriate cause value.

If the network determines that a call independent signalling connection is not authorized or available, cause #63, "service option not available, unspecified, will be used".

7.2.1.2.1.1.3 Call proceeding

If the NCICS request is valid and can be processed, the network shall:

- return a CALL PROCEEDING message;
- enter the Outgoing Call Proceeding state;
- attempt to establish the NCICS towards the terminating entity (for example, see subclause 7.2.1.2.1.2).

Upon receipt of the CALL PROCEEDING message, the user shall stop timer T303, enter the outgoing call proceeding state, and start timer T310. If timer T310 expires, the user shall initiate NCICS clearing towards the network in accordance with subclause 7.2.1.2.1.3 using cause No. 102, *recovery on timer expiry*.

7.2.1.2.1.1.4 Connection connected

Upon the network receiving an indication that the NCICS request has been accepted, the network shall send a CONNECT message across the originating user-network interface, and either: enter the Active state, or start timer T313 and enter the Connect request state.

This message indicates to the originating user that a NCICS connection has been established through the network.

On receipt of the CONNECT message, the originating user shall send a CONNECT ACKNOWLEDGE message, stop timer T310, and shall enter the active state.

On receipt of a CONNECT ACKNOWLEDGE message, the network shall:

- take no action, if it perceives the NCICS connection to be in the Active state;
- if in the connect request state, stop timer T313 and enter the Active state.

If timer T313 expires before a CONNECT ACKNOWLEDGE message is received, the network shall initiate NCICS connection clearing with a RELEASE message using cause value 102, *recovery on timer expiry*.

7.2.1.2.1.1.5 Connection rejected

Upon receiving an indication that the network or the terminating entity is unable to accept the NCICS request, the network shall initiate NCICS connection clearing at the originating user-network interface as described in subclause 7.2.1.2.1.3, using the cause provided by the terminating network or the terminating entity.

7.2.1.2.1.2 Connection establishment at the destination interface

Before these procedures are invoked, a reliable data link connection must be established between the user (TE/NT2) and the network. All layer 3 messages shall be sent to the data link layer using a DL-DATA request primitive. The data link services described in EN 300 402-2 [4] are assumed.

The call reference contained in all messages exchanged across the user-network interface shall contain the call reference value specified in the SETUP message delivered by the network. In selecting a call reference, the dummy call reference shall not be used in conjunction with NCICS connections.

7.2.1.2.1.2.1 Incoming connection

The network will indicate the arrival of a NCICS connection at the user-network interface by transferring a SETUP message across the interface. Refer to subclause 11.1.2.7 for the contents of the SETUP message.

After sending the SETUP message, the network shall start timer T303, and enter the Call Present state. If the network does not receive a response to the SETUP message prior to the expiry of timer T303, the network shall retransmit the SETUP message and restart timer T303.

The FACILITY message can only be exchanged when the NCICS connection is in the active state.

7.2.1.2.1.2.2 Connection confirmation

When the user determines that sufficient NCICS connection set-up information has been received, the user shall respond with a CALL PROCEEDING message and enter the Incoming Call Proceeding state.

Upon receipt of the CALL PROCEEDING message, the network shall stop timer T303, enter the Incoming Call Proceeding state, and start timer T310.

7.2.1.2.1.2.3 Called user clearing during incoming connection establishment

If a RELEASE or RELEASE COMPLETE message is received before a CONNECT message has been received, the network shall stop timer T303 or T310 (if running); continue to clear the terminating entity as described in subclause 7.2.1.2.1.3, and clear the NCICS connection to the originating entity with the cause received in the RELEASE or RELEASE COMPLETE message.

7.2.1.2.1.2.4 Connection failure

If the network does not receive any response to the retransmitted SETUP message prior to the expiration of timer T303, then the network shall initiate clearing procedures towards the originating entity with cause No. 18, no user responding. The network shall also initiate clearing procedures towards the terminating entity in accordance with subclause 7.2.1.2.1.3, using cause No. 102, recovery on timer expiry.

If the network has received a CALL PROCEEDING message, but does not receive a CONNECT, RELEASE, or RELEASE COMPLETE message prior to the expiration of timer T310, then the network shall initiate clearing towards the terminating entity. The terminating entity shall be cleared in accordance with subclause 7.2.1.2.1.3, using cause No. 102, *recovery on timer expiry*. In addition, the network shall initiate clearing towards the originating entity in accordance with subclause 7.2.1.2.1.3, using cause No. 18, *no user responding*.

7.2.1.2.1.2.5 Connection accept

The terminating entity indicates acceptance of an incoming NCICS connection by sending a CONNECT message to the network. Upon sending the CONNECT message, the terminating entity may start timer T313.

7.2.1.2.1.2.6 Active indication

On receipt of a CONNECT message, the network shall stop (if running) timers T303 and T310; complete the NCICS connection; send a CONNECT ACKNOWLEDGE message to the terminating entity; initiate procedures to send a CONNECT message towards the originating entity and enter the active state.

The CONNECT ACKNOWLEDGE message indicates completion of the NCICS connection. There is no guarantee of an end-to-end connection until the originating entity receives a CONNECT message. Upon receipt of the CONNECT ACKNOWLEDGE message, the user shall stop timer T313, if running, and enter the active state.

If timer T313 expires prior to receipt of a CONNECT ACKNOWLEDGE message, the user shall initiate clearing in accordance with subclause 7.2.1.2.1.3, using cause No. 102, recovery on timer expiry.

The exchange of FACILITY messages can start once the NCICS connection has reached the active state.

7.2.1.2.1.3 Connection clearing

7.2.1.2.1.3.1 Exception conditions

Under normal conditions, NCICS clearing is usually initiated when the user or the network sends a RELEASE message and follows the procedures defined in subclauses 7.2.1.2.1.3.3 and 7.2.1.2.1.3.4 respectively. The only exception to the above rule is the following. In response to a SETUP message, the user or network can reject a NCISC by responding with a RELEASE COMPLETE message provided no other response has previously been sent (e.g. the CALL PROCEEDING message); releasing the call reference, and enter the Null state.

7.2.1.2.1.3.2 Clearing initiated by the user

Apart from the exception identified in subclauses 7.2.1.2.1.3.1 and 7.2.1.2.1.6, the user shall initiate clearing by sending a RELEASE message; starting timer T308 and entering the Release Request state.

On receipt of a RELEASE message, the network shall send a RELEASE COMPLETE message; release the call reference; and enter the null state.

On receipt of the RELEASE COMPLETE message the user shall cancel timer T308; release the call reference; and return to the Null state. If timer T308 expires for the first time, the user shall retransmit the RELEASE message and timer T308 shall be restarted. In addition, the user may indicate a second Cause information element with cause No. 102, *recovery on timer expiry*. If no RELEASE COMPLETE message is received from the network before timer T308 expires a second time, the user shall release the call reference and return to the Null state.

7.2.1.2.1.3.3 Clearing initiated by the network

Apart from the exception identified in subclauses 7.2.1.2.1.3.1 and 7.2.1.2.1.6, the network shall initiate clearing by sending a RELEASE message; starting timer T308 and entering the Release Request state.

On receipt of a RELEASE message, the user shall send a RELEASE COMPLETE message; release the call reference; and enter the null state.

On receipt of the RELEASE COMPLETE message the network shall cancel timer T308; release the call reference; and return to the Null state. If timer T308 expires for the first time, the network shall retransmit the RELEASE message and timer T308 shall be restarted. In addition, the network may indicate a second Cause information element with cause No. 102, *recovery on timer expiry*. If no RELEASE COMPLETE message is received from the user before timer T308 expires a second time, the network shall release the call reference and return to the Null state.

7.2.1.2.1.3.4 Clear collision

Clear collision can occur when both sides simultaneously transfer RELEASE messages related to the same call reference value. The entity receiving such a RELEASE message whilst within the Release Request state shall stop timer T308; release the call reference and enter the Null state (without sending or receiving a RELEASE COMPLETE message).

7.2.1.2.1.4 Interaction with restart procedure

When a RESTART message is either sent or received and the Restart indicator information element is coded:

1) "all interfaces"; or

2) "single interface" and the interface contains the D-Channel;

the user and the network shall release all NCICS connections.

7.2.1.2.1.5 Interaction with call rearrangements

The receipt of a SUSPEND, SUSPEND ACKNOWLEDGE, SUSPEND REJECT, RESUME, RESUME ACKNOWLEDGE, or RESUME REJECT, shall be treated as the receipt of an unexpected or unrecognized message in accordance with subclause 5.8.4 of EN 300 403-1 [2].

7.2.1.2.1.6 Handling of error conditions

The error handling procedures described in subclause 5.8 of EN 300 403-1 [2] shall apply to NCICS with the following modifications:

- a "call" should be interpreted as "call or NCICS connection";
- actions regarding the handling of B-channels are not applicable;
- actions regarding the handling of the DISCONNECT message (not defined for use with NCICS connections) are not applicable;
- on Data Link failure, for connections in the Active state, the NCICS connections may be released (i.e., release the call reference and enter the Null state) as an alternative to the procedures specified for active calls in EN 300 403-1 [2];
- if a SETUP ACKNOWLEDGE, ALERTING, DISCONNECT, SUSPEND, SUSPEND ACKNOWLEDGE, SUSPEND REJECT, RESUME, RESUME ACKNOWLEDGE, RESUME REJECT, INFORMATION, or PROGRESS message (defined in EN 300 403-1 [2]) or HOLD, HOLD ACKNOWLEDGE, HOLD REJECT, RETRIEVE, RETRIEVE ACKNOWLEDGE, RETRIEVE REJECT, or REGISTER (defined in EN 300 196-1 [1]) is received in any state for a NCICS connection (except the Null state), it shall be treated as an unexpected or unrecognized message in accordance with subclause 5.8.4 of EN 300 403-1 [2].

7.2.1.2.1.7 Protocol timer values

The following timers which are specified in clause 9 of EN 300 403-1 [2] are applicable to NCICS connections: T303, T308, T309, T310, T313, and T322. All other timers in clause 9 of EN 300 403-1 [2] are not applicable to NCICS connections.

7.2.1.2.2 GFT-Control requirements

Subclause 7.3.3 of ISO/IEC 11582 [5] shall apply.

NOTE: These requirements only apply to PINX entities that terminate the GFT-Control protocol. Otherwise, the Facility information element will be transferred to the next entity regardless of the contents of the destinationEntity element in the NFE. Some nodal entities may not terminate the GFT-Control protocol, while providing minimum Transit PINX functions required.

7.2.1.3 Connectionless bearer independent transport mechanism

Not supported.

8 Generic notification procedures

8.1 Procedures applicable for signalling in a VPN context

8.1.1 Categories of notifications

Subclause 7.4.1 of ISO/IEC 11582 [5] shall apply.

8.1.2 Non-standardized notifications

Non-standardized notifications may occur in the CTN as part of non-standardized supplementary services or as additions to standardized supplementary services. If provided, they shall be encoded and transported across the VPN in accordance with the rules for standardized notifications (see subclauses 9.2.3, 9.3.4, 11.1 and 11.2.2).

Non-standardized notifications shall make use of the type NotificationDataStructure in octet 4 of the Notification information element (see subclause 11.2.2). Elements of type NotificationDataStructure shall include an element notificationTypeID of type OBJECT IDENTIFIER. Additional information accompanying standardized notifications shall be included in element notificationArgument.

Non-standardized notifications shall not make use of the notification description field (octet 3) of the Notification indicator information element, other than to include the 'discriminator for extension to ASN.1 encoded component for ISO' codepoint (see subclause 10.2.2).

8.1.3 Protocol control requirements

Subclause 7.4.2 of ISO/IEC 11582 [5] shall apply with the following exception:

The text of the third paragraph in subclause 7.4.2.1 of ISO/IEC 11582 [5] is replaced by the following text:

However,

- if a SETUP message has been sent, but no response has been received from the peer entity at the other side of the interface;
- if a SETUP message has been received, but no response has been sent to the peer entity at the other side of the interface interface; or

- if a clearing message has already been sent to or received from the peer entity at the other side of the interface;

the notification information shall be discarded.

8.1.4 GFT-Control requirements

Subclause 7.4.3 of ISO/IEC 11582 [5] shall apply.

9 Application layer requirements

9.1 Coordination Function requirements

Subclause 8.1 of ISO/IEC 11582 [5] shall apply.

9.2 ROSE requirements

Subclause 8.2 of ISO/IEC 11582 [5] shall apply.

10 Other generic procedures

These procedures shall be used only in a public network context. Clause 10 of EN 300 196-1 [1] shall apply.

11 Coding requirements

The coding requirements in this clause apply to the VPN context. The coding requirements applicable to the public network context are outside the scope of the present document.

11.1 Message functional definitions and content

11.1.1 Messages for bearer-related signalling

Subclause 11.1.1 of EN 300 196-1 [1] shall apply with the following difference:

Replace table 5 of EN 300 196-1 [1] with the following:

Message type: FACILITY
Significance: local or global (note)
Direction: both

Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	EN 300 403-1 [2], subclause 4.2	both	M	1
Call reference	EN 300 403-1 [2], subclause 4.3	both	M	2-3
Message type	EN 300 196-1 [1], subclause 11.2.1	both	M	1
Facility	EN 300 196-1 [1], subclause 11.2.2.1	both	M	8-*
Notification indicator	EN 300 196-1 [1], subclause 11.2.2.2	both	O	2-*

M Mandatory
O Optional
NOTE: This message has local significance, however, it may carry information of global significance. For VPN applications, this message has a global significance when it contains a facility information element with a protocol profile coded "Networking Extensions".

11.1.2 Messages for call independent, connection-oriented signalling

This subclause defines the messages that are associated with NCICS. For certain messages, reference is made to other clauses of the present document or to EN 300 403-1 [2] where it is noted that there is change necessary to an already defined message. Where there is a change, the entire message and applicable information elements are shown here. The Display information element defined in EN 300 403-1 [2] is not applicable to NCICS.

11.1.2.1 CALL PROCEEDING

This message is sent by the called user to the network or by the network to the calling user to indicate that requested NCICS connection establishment has been initiated and no more NCICS connection establishment information will be accepted (see table 1).

Table 1: CALL PROCEEDING message content

Message type: CALL PROCEEDING Significance: local Direction: both				
Information element	**Reference (subclause)**	**Direction**	**Type**	**Length**
Protocol discriminator	EN 300 403-1 [2], subclause 4.2	Both	M	1
Call reference	EN 300 403-1 [2], subclause 4.3	Both	M	2-3
Message type	EN 300 403-1 [2], subclause 4.4	Both	M	1
Channel identification	subclause 11.2.4	Both	O	3

11.1.2.2 CONNECT

This message is sent by the called user to the network and by the network to the calling user, to indicate NCICS connection acceptance by the called user (see table 2).

Table 2: CONNECT message content

Message type: CONNECT Significance: global Direction: both				
Information element	**Reference (subclause)**	**Direction**	**Type**	**Length**
Protocol discriminator	EN 300 403-1 [2], subclause 4.2	Both	M	1
Call reference	EN 300 403-1 [2], subclause 4.3	Both	M	2-3
Message type	EN 300 403-1 [2], subclause 4.4	Both	M	1
Facility	subclause 11.2.1	Both	O (note)	2-*
Notification indicator	EN 300 196-1 [1], subclause 11.2.2.2	Both	O	2-*
Connected number	EN 301 060-1 [3], subclause 7.2.3	Both	O	4-*
NOTE: Included if a component needs to be exchanged.				

11.1.2.3 CONNECT ACKNOWLEDGE

This message is sent by the network to the called user to indicate the user has been awarded the NCICS connection. It may also be sent by the calling user to the network to allow symmetrical NCICS control procedures. See subclause 3.3.5 of EN 300 403-1 [2].

11.1.2.4 FACILITY

This message may be sent to request or acknowledge a supplementary service. See subclause 11.1.1 for more information.

11.1.2.5 RELEASE

This message is sent by the user or the network to indicate that the equipment sending the message intends to release the call reference. Thus the receiving equipment should clear the NCICS connection and prepare to release the call reference after sending a RELEASE COMPLETE (see table 3).

Table 3: RELEASE message content

Message type: RELEASE
Significance: local (note 1)
Direction: both

Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	EN 300 403-1 [2], subclause 4.2	Both	M	1
Call reference	EN 300 403-1 [2], subclause 4.3	Both	M	2-3
Message type	EN 300 403-1 [2], subclause 4.4	Both	M	1
Cause	EN 300 403-1 [2], subclause 4.5	Both	M	2-32
Facility	subclause 11.2.1	Both	O (note 2)	2-*

NOTE 1: This message has local significance; however, it may carry information of global significance when used as the first clearing message.
NOTE 2: Included if a component needs to be exchanged.

11.1.2.6 RELEASE COMPLETE

This message is sent by the user or the network to indicate that the equipment sending the message has cleared the NCICS connection, released the call reference and the receiving equipment shall release the call reference (see table 4).

Table 4: RELEASE COMPLETE message content

Message type: RELEASE COMPLETE
Significance: local (note 1)
Direction: both

Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	EN 300 403-1 [2], subclause 4.2	Both	M	1
Call reference	EN 300 403-1 [2], subclause 4.3	Both	M	2-3
Message type	EN 300 403-1 [2], subclause 4.4	Both	M	1
Cause	EN 300 403-1 [2], subclause 4.5	Both	O (note 2)	2-32
Facility	subclause 11.2.1	Both	O (note 3)	2-*

NOTE 1: This message has local significance; however, it may carry information of global significance when used as the first clearing message.
NOTE 2: Mandatory in the first clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.
NOTE 3: Included if a component needs to be exchanged.

11.1.2.7 SETUP

This message is sent by the originating user to the network and by the network to the terminating user to initiate NCICS connection establishment (see table 5).

Table 5: SETUP message content

Message type: SETUP
Significance: global
Direction: both

Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	EN 300 403-1 [2], subclause 4.2	Both	M	1
Call reference	EN 300 403-1 [2], subclause 4.3	Both	M	2-3
Message type	EN 300 403-1 [2], subclause 4.4	Both	M	1
Sending complete	EN 300 403-1 [2], subclause 4.5	Both	O (note 1)	1
Bearer capability	subclause 11.2.3	Both	M	4-12
VPN indicator	EN 301 060-1 [3], subclause 7.2.7	Both	O (note 3)	2-15
Channel identification	subclause 11.2.4	Both	O (note 5)	3
Facility	subclause 11.2.1	Both	O (note 2)	2-*
Calling party number	subclause 7.2.2	Both	O (note 4)	2-*
Called party number	subclause 7.2.1	Both	M	2-*
Transit counter (note 6)	ISO/IEC 15056 [9]	Both	O	3

NOTE 1: Included if the user or the network optionally indicates that all information necessary for NCICS establishment is included in the SETUP message.
NOTE 2: Included if a component needs to be exchanged.
NOTE 3: Mandatory if the SETUP message is sent in a VPN context.
NOTE 4: May be included by the originating user or the network to identify the originating user.
NOTE 5: May be included by the originating user or the network to indicate the D-channel is being used.
NOTE 6: This information element appears in codeset 4. This information element is therefore preceded by a Locking Shift information element or a Non-locking Shift information element, as described in subclause 4.5.2 of ETS 300 403-1 [2]. The choice whether the Locking Shift or the Non-locking Shift information element is used is an implementation option. The information elements in the message must appear in the order specified in subclause 4.5 of ETS 300 403-1 [2]. This order may differ from the one shown in this table.

11.1.2.8 STATUS

This message is sent by the user or the network in response to a STATUS ENQUIRY message or at any time during a NCICS connection or to report certain error conditions listed in subclause 5.8 of EN 300 403-1 [2]. See subclause 3.3.11 of EN 300 403-1 [2] for more information.

11.1.2.9 STATUS ENQUIRY

This message is sent by the user or the network at any time to solicit a STATUS message from the peer layer 3 entity. See subclause 3.3.12 of EN 300 403-1 [2] for more information.

11.2 General message format and information element coding

Subclause 11.2 of EN 300 196-1 [1] shall apply with the following differences:

11.2.1 Facility

Replace the existing figure 1 of EN 300 196 [1] with the following:

Table 6: Facility information element

8	7	6	5	4	3	2	1	
0	Facility 0	0	1	1	1	0	0	Octet 1
	Information element identifier							
Length of Facility information element								2
1 Ext.	0 spare	0	Protocol profile					3
Network Facility Extension (notes 1 & 5)								3.1*
Network Protocol Profile (notes 2 & 5)								3.2*
Interpretation Component (notes 3 & 5)								3.3*
Service Components (note 4)								4, etc.

NOTE 1: A component of type Network Facility Extension may be included.

NOTE 2: A component of type Network Protocol Profile may be included to specify the contents of the component of type Service Component (other than ROSE) when the Protocol profile field in Octet 3 contains the value "Networking Extensions". To indicate that the contents of the Service Component field is ROSE, the Network Protocol Profile Component shall be excluded.

NOTE 3: A component of type Interpretation Component may be included, as specified in subclause 1.1.

NOTE 4: One or more components of type Service Component may be included.

NOTE 5: Octet groups 3.1 through 3.3 may only be included when the Protocol profile field in Octet 3 contains the value "Networking Extensions".

Protocol profile (octet 3):

Bits 5	4	3	2	1	Meaning
1	1	1	1	1	Networking Extension (note 6)
All other values are reserved					

NOTE 6: When this codepoint is used, the NFE, NPP, and the Interpretation components can be included. In this case, only ISO/IEC defined local values apply. For consistency with ISO/IEC 11582 [5], a Facility information element with the protocol profile of "Networking Extensions" shall not be permitted in the SETUP ACKNOWLEDGE, CALL PROCEEDING, and CONNECT ACKNOWLEDGE messages.

The coding of the Network Facility Extension field (octet 3.1) is specified in subclause 11.3.3.1 of ISO/IEC 11582 [5].

The coding of the Network Protocol Profile field (octet 3.2) is specified in table 29 of ISO/IEC 11582 [5].

The coding of the Interpretation APDU field (octet 3.3) is specified in subclause 11.3.3.2 of ISO/IEC 11582 [5]

11.2.2 Notification indicator

The following additional codepoints (in addition to those already contained in ETS 300 196-1 [1]) are either reserved or allocated.

Notification description (octet 3)

Extension [bit 8 Octet 3] is set to 1

```
Bits
7 6 5 4 3 2 1
_____________

0 1 0 0 0 0 0 ---
          .       |
          .       | - - -   Reserved for ISO
          .       |
0 1 1 1 1 1 1 ---
1 0 0 0 0 0 0   discriminator for extension to ASN.1 encoded component for ISO (Note)
```

All other values are reserved or defined in the standards for individual supplementary services.

Notification Description value 'discriminator for extension to ASN.1 encoded component for ISO' is used for notifications using ASN.1. Such notifications are defined in table 39 in annex B of ISO/IEC 11582 [5] and contain a notification value of type INTEGER or OBJECT IDENTIFIER (in element notificationTypeId) and optionally additional data (in element notificationArgument).

Table 39 in annex B of ISO/IEC 11582 [5] also defines the notification pss1IeNotification, which can be used to convey PSS1 information elements as a notification. Other notifications will be defined using the Notification macro in the relevant supplementary services specifications (standardized or non-standardized).

11.2.3 Bearer capability

The Bearer capability information element is defined in subclause 4.5.5 of EN 300 403-1 [2]. This subclause describes the fields and the valid coding of those fields that shall be used in conjunction with Networked Call Independent Signalling Connections described in subclause 7.2.1.2. For NCICS, the Bearer capability information element shall consist only of octets 1, 2, 3, and 4 as shown in figure 1 and as coded in table 7.

	Bits							
8	7	6	5	4	3	2	1	Octets
0	Bearer capability 0	0	0	0	1	0	0	1
	Information element identifier							
Length of the bearer capability contents (note 1)								2
1 ext.	Coding standard		Information transfer capability					3
1 ext.	Transfer mode		Information transfer rate					4

NOTE 1: This octet is coded to an integer value of 2 (i.e. "0 0 0 0 0 0 1 0").

Figure 1: Bearer capability information element

Table 7: Bearer capability information element for NCICS

Coding standard (octet 3)

```
Bits
7 6
0 1          ISO/IEC
```

Information transfer capability (octet 3)

```
Bits
5 4 3 2 1
0 1 0 0 0    Unrestricted digital information
```

Transfer mode (octet 4)

```
Bits
7 6
0 0          Networked Call Independent Signalling Connection
```

Information transfer rate (octets 4 , bits 5 to 1)

```
Bits
5 4 3 2 1
0 0 0 0 0    Networked Call Independent Signalling Connections
```

11.2.4 Channel identification

The Channel identification information element is used in NCICS to identify the D-Channel as the channel over which the NCICS connection is to be established. In this context, the Channel identification information element may attain a maximum length of 3 octets as shown in figure 2 below. This figure is based on figure 4-18 of EN 300 403-1 [2] where octets that are not applicable to NCICS have been removed.

	Bits							
8	7	6	5	4	3	2	1	Octets
0	Channel identification 0	0	1	1	0	0	0	1
	Information element identifier							
Length of channel identification contents								2
1 ext.	Int. id. present	Int. type	0 spare	Pref./Excl.	D-channel ind.	Info. channel selection		3

Figure 2: Channel identification information element

Table 8: Channel identification information element

Interface identifier present (octet 3)

```
Bit
7
0          Interface implicitly identified (note 1)
```

NOTE 1: The interface which includes the D-channel carrying this information element is indicated.

Interface type (octet 3)

```
Bit
6
      0                   Basic interface
1          Other interface e.g. primary rate (note 2)
```

NOTE 2: The type of interface should be understood because the interface is identified by the "interface identifier present" field (octet 3, bit 7) and the interface identifier field (octet 3.1), if any.

Preferred/Exclusive (octet 3)

```
Bit
4
1          Exclusive; only the indicated channel is acceptable
```

NOTE 3: Preferred/exclusive has significance only for B-channel selection.

D-channel indicator (octet 3)

```
Bit
3
1          The channel identified is the D-channel
```

Information channel selection (octet 3)

```
Bits

2  1

0  0       No channel
```

Annex A (normative): Dynamic descriptions

A.1 Dynamic description of the Hold and Retrieve functions

Subclause A.1 of EN 300 196-1 [1] shall apply.

A.2 Dynamic description of the status request procedure

Subclause A.2 of EN 300 196-1 [1] shall apply.

A.3 Dynamic description of the supplementary service management function

Subclause A.3 of EN 300 196-1 [1] shall apply.

A.4 Dynamic description of the connection oriented bearer independent transport mechanism

Figure 9 of ISO/IEC 11582 [5] shall apply.

Annex B (normative): Formal definition of data types

Annex D of EN 300 196-1 [1] and annex B of ISO/IEC 11582 [5] shall apply.

Annex C (normative): Flow control

As a network option, network flow control mechanisms as described below may exist to restrict FACILITY and NOTIFY message flow on a call reference basis.

A burst capability of sending N FACILITY and NOTIFY messages shall immediately be available to each user, where N initially equals the value of the burst parameter X. The value of N shall be decremented by one for every FACILITY and NOTIFY message sent by the user and incremented by Y at regular intervals of T. If the value exceeds X when N is incremented by Y, then the value of N shall be set to X.

The values of the burst parameter X and the replenishment parameter Y, the implementation of the timer T and its value are network options.

If the network receives more than N FACILITY and/or NOTIFY messages with the period T, the excess message(s) shall be discarded.

History

Document history				
V1.1.1	August 1997	Public Enquiry	PE 9748:	1997-08-01 to 1997-11-28