
**Information technology —
Telecommunications and information
exchange between systems — Broadband
Private Integrated Services Network —
Inter-exchange signalling protocol —
Basic call/connection control**

*Technologies de l'information — Télécommunications et échange
d'information entre systèmes — Réseau privé à large bande à intégration
de services — Protocole de signalisation d'échange — Appel de
base/contrôle de connexion*



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Foreword

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

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 13247 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

Annexes A and B form an integral part of this International Standard. Annexes C to L are for information only.

Introduction

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

This particular International Standard specifies the signalling protocol for use at the Q reference point for basic call/connection control (B-QSIG-BC).

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Information technology — Telecommunications and information exchange between systems — Broadband Private Integrated Services Network — Inter-exchange signalling protocol — Basic call/connection control

1 Scope

This International Standard defines the signalling protocol for the purpose of basic call/connection control at the Q reference point between Private Integrated Services Network Exchanges (PINXs) connected together within a Broadband Private Integrated Services Network (B-PISN) employing Asynchronous Transfer Mode (ATM). This International Standard is part of the B-QSIG signalling system.

The Q reference point is defined in ISO/IEC 11579-1.

This International Standard is an application of the signalling protocol that forms part of the ATM Forum's PNNI 1.0 specification, which in turn is based on ITU-T Recommendation Q.2931, including the provisions for symmetrical operation described in annex H of recommendation Q.2931. Technical differences compared with the signalling protocol specified in PNNI 1.0 are summarized in annex J. Guidelines for interworking between a network employing the signalling protocol specified in this International Standard and a network employing the ATM Forum's PNNI 1.0 specification are given in annex L.

This International Standard is applicable to PINXs which interconnect to form a B-PISN using static hop-by-hop routing. It therefore complements the ATM Forum's PNNI 1.0 specification, which is applicable to networks that employ dynamic source routing.

The basic capabilities supported by the protocol specified in this International Standard are listed below and described in more detail in annex F:

- demand (switched) virtual channel and virtual path connections;
- point-to-point switched virtual channel and virtual path connections;
- point-to-multipoint virtual channel connections;
- connections with symmetric or asymmetric bandwidth requirements;
- single-connection (point-to-point) calls;
- basic signalling functions via protocol messages, information elements, and procedures;
- CBR, VBR (realtime and non-realtime), UBR and ABR service categories;
- negotiation of certain signalling parameters;
- inter-PINX virtual channel identifier (IPVCI) negotiation;
- out-of-band signalling for all signalling messages;
- error recovery;
- B-PISN addressing formats;
- end-to-end compatibility parameter identification;
- signalling interworking with N-PISN and provision of N-PISN services;
- forward compatibility;
- call/connection handling at different types of PINX, including Transit PINX, Originating PINX, Terminating PINX, Incoming Gateway PINX, Outgoing Gateway PINX and Interworking PINX;
- Signalling of individual QoS parameters
- ATM anycast addresses
- Negotiation of ATM traffic descriptors

- Soft PVPC and PVCC support
- Generic Identifier Transport

2 Conformance

In order to conform to this International Standard, a PINX shall satisfy the requirements identified in the Protocol Implementation Conformance Statement (PICS) proforma in annex A.

3 Normative references

3.1 References from ISO, IEC or ITU-T

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 8348:1996, *Information technology — Open Systems Interconnection — Network Service Definition*.

ISO/IEC 9646-1:1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 1: General concepts*.

ISO/IEC 9646-7:1995, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 7: Implementation Conformance Statements*.

ISO/IEC 11571:1994, *Information technology — Telecommunications and information exchange between systems — Numbering and sub-addressing in private integrated services networks*.

ISO/IEC 11572:1997, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit mode bearer services — Inter-exchange signalling procedures and protocol*.

ISO/IEC 11574:1994, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit-mode 64 kbit/s bearer services — Service description, functional capabilities and information flows*.

ISO/IEC 11584:1996, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit-mode multi-rate bearer services — Service description, functional capabilities and information flows*.

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

ISO/IEC 13246:1997, *Information technology — Telecommunications and information exchange between systems — Broadband Private Integrated Services Network — Inter-exchange signalling protocol — Signalling ATM adaptation layer*.

CCITT Rec. E.164:1991, *Numbering plan for the ISDN era*.

CCITT Rec. I.112:1988, *Vocabulary of terms for ISDNs (Blue Book)*.

CCITT Rec. I.330:1988, *ISDN numbering and addressing principles (Blue Book)*.

CCITT Rec. Q.9:1988, *Vocabulary of switching and signalling terms (Blue Book)*.

CCITT Rec. Z.100:1988, *Specification and Description Language (Blue Book)*.

ITU-T Rec. I.321:1991, *B-ISDN protocol reference model and its application*.

ITU-T Rec. I.363:1996, *B-ISDN ATM adaptation layer (AAL) specification*.

ITU-T Rec. I.371:1996, *Traffic control and congestion control in B-ISDN*.

ITU-T Rec. I.610:1994, *B-ISDN operation and maintenance principles and functions*.

ITU-T Rec. Q.2931:1995, *Broadband Integrated Services Digital Network (B-ISDN) — Digital Subscriber Signalling System No. 2 (DSS2) — User-Network Interface (UNI) layer 3 specification for basic call/connection control*.

ITU-T Rec. Q.2971:1996, *Broadband Integrated Services Digital Network (B-ISDN) — Digital Subscriber Signalling System No. 2 (DSS2) — User-Network Interface (UNI) layer 3 specification for point-to-multipoint call/connection control*.

3.2 **References from other sources**

All references in this subclause were correct at the time of approval of this International Standard. The provisions of the referenced specifications, as identified in this subclause, are valid within the context of this IS. The reference to a specification within this IS does not give it any further status within ISO/IEC; in particular, it does not give the referenced specification the status of an International Standard.

- ATM Forum PNNI 1.0: 1996, *Private Network-Network Interface Specification Version 1.0 (af-pnni-0055.000)*.
- ATM Forum UNI 4.0: 1996, *User-Network Interface (UNI) Signalling Specification Version 4.0 (af-sig-0061.000)*

4 **Definitions**

For the purposes of this International Standard, the following definitions apply.

4.1 **Definitions in PNNI 1.0**

References contained in sections 2.2 and 6.1 of PNNI 1.0 are applicable with the exception of the definitions applicable to the routing sections of PNNI 1.0 and with the exception of terms for which there are replacement definitions in 4.2 and 4.3 of this International Standard.

Where text of PNNI 1.0 is referenced from this International Standard, terms used within the referenced text shall be interpreted as shown in Table 1.

Table 1 — Interpretation of PNNI terms

Term used in PNNI referenced text	Interpretation for the purposes of this International Standard
network node	PINX
call	call/connection
logical link	inter-PINX link (IPL)
physical link	inter-PINX link (IPL)
virtual channel identifier (VCI)	inter-PINX virtual channel identifier (IPVCI)
virtual path identifier (VPI)	inter-PINX virtual path identifier (IPVPI)
PNNI interface	inter-PINX link (IPL)
PNNI link	inter-PINX link (IPL)

4.2 **Other external definitions**

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

- ATM transfer capability (ATC) (ITU-T Rec. I.371)
- connection (CCITT Rec. Q.9)
- F5 (ITU-T Rec. I.610)
- private integrated services network (PISN) (ISO/IEC 11579-1)
- private integrated services network exchange (PINX) (ISO/IEC 11579-1)
- signalling (CCITT Rec. I.112)
- user plane (CCITT Rec. I.321)

4.3 **Other definitions**

4.3.1 **ATM endsystem address:** the address of a point of attachment to an ATM network.

4.3.2 **broadband private integrated services network (B-PISN):** a PISN that offers ATM services to its users and

employs ATM transmission between PINXs and ATM switching.

4.3.3 call: an association between two or more users for the use or attempted use of a telecommunication service.

4.3.4 call/connection: a call combined with a single connection in the user plane for the transfer of user information.

4.3.5 en bloc: a method of signalling the called party number information in which all called party number digits are sent in the first message.

4.3.6 gateway PINX: within the context of a call/connection, a PINX which performs interworking between B-QSIG and another signalling system.

4.3.7 incoming call/connection: a call/connection using an IPL from the point of view of the succeeding side of that IPL.

4.3.8 incoming gateway PINX: a Gateway PINX that routes a call/connection from a route employing another signalling system on to an IPL employing B-QSIG signalling. (See Figure 1.)

4.3.9 information element: a component of a message.

4.3.10 information element with invalid contents: an information element that is recognized, but whose contents cannot be interpreted as valid using the rules specified in clause 8 of this International Standard, or that contains field values that are marked as «reserved» in clause 8 of this International Standard.

4.3.11 inter-PINX link (IPL): a link between the Q reference points of two PINXs, the link comprising a signalling IPVC together with one or more user information IPVCs under the control of that signalling IPVC.

4.3.12 inter-PINX virtual channel (IPVC): one of a number of bi-directional transfers of digital information, multiplexed at the ATM layer, between two PINXs.

NOTE 1. An IPVC can be a single virtual channel or a concatenation of virtual channels.

4.3.13 inter-PINX virtual channel identifier (IPVCI): an integer that identifies an IPVC within the context of an IPVP.

4.3.14 inter-PINX virtual path (IPVP): a grouping of one or more IPVCs within a single IPL.

4.3.15 inter-PINX virtual path identifier (IPVPI): an integer that identifies an IPVP within the context of an IPL.

4.3.16 interworking PINX: within the context of a call/connection, a PINX that performs interworking between a B-PISN and a N-PISN.

NOTE 2. An interworking PINX will also be either an Originating PINX, a Terminating PINX or a Gateway PINX.

4.3.17 narrow-band private integrated services network (N-PISN): a PISN that offers only 64 kbit/s-based services to its users.

4.3.18 originating PINX: within the context of a call/connection, the PINX to which the calling user is attached. (See Figure 1.)

4.3.19 outgoing call/connection: a call/connection using an IPL from the point of view of the preceding side of that IPL.

4.3.20 outgoing gateway PINX: a Gateway PINX that routes an incoming call/connection from an IPL employing B-QSIG signalling on to a route employing another signalling system. (See Figure 1.)

4.3.21 overlap: a method of signalling the called party number information in which not all called party number information is sent in the same message.

4.3.22 preceding PINX: within the context of a call/connection using an IPL, the PINX to which the preceding side of the IPL belongs, from the point of view of the PINX to which the succeeding side of the IPL belongs.

4.3.23 preceding side: in the context of a call/connection using an IPL, the side that initiates call/connection establishment over that IPL. (See Figure 1.)

4.3.24 public broadband ISDN (public B-ISDN): a public ISDN that offers ATM services to its users and employs ATM transmission and switching.

4.3.25 public integrated services digital network (public ISDN): a network that provides to the general public a range of different telecommunication services using digital connections.

4.3.26 public narrow-band ISDN (public N-ISDN): a public ISDN that offers to the general public only 64 kbit/s-based services.

- 4.3.27 side:** the Protocol Control entity in a PINX at one end of an IPL.
- 4.3.28 signalling AAL (SAAL):** the AAL used for the bi-directional transfer of layer 3 signalling information.
- 4.3.29 succeeding PINX:** within the context of a call/connection using an IPL, the PINX to which the succeeding side of the IPL belongs, from the point of view of the PINX to which the preceding side of the IPL belongs.
- 4.3.30 succeeding side:** in the context of a call/connection using an IPL, the opposite side from the side that initiates call/connection establishment over that IPL. (See Figure 1.)
- 4.3.31 terminating PINX:** within the context of a call/connection, the PINX to which the called user is attached. (See Figure 1.)
- 4.3.32 transit PINX:** within the context of a call/connection, any PINX through which the call/connection passes, excluding any Originating PINX, Terminating PINX, Incoming Gateway PINX or Outgoing Gateway PINX. (See Figure 1.)
- 4.3.33 unexpected message:** within the context of a particular Protocol Control state, a message that is recognized, but for which no procedures are defined in 9.6 of this International Standard (or in any other Standard relating to B-QSIG to which the PINX claims conformance) for receipt in that Protocol Control state.
- 4.3.34 unrecognized information element:** an information element received in a particular message which is not specified as part of that message in clause 7 of this International Standard or in any other Standard relating to B-QSIG to which the PINX claims conformance (e.g., a Standard specifying generic procedures for supplementary services).
- NOTE 3. The handling of national/private information elements is outside the scope of this International Standard (see annex H).
- 4.3.35 unrecognized message:** a message that is not specified in clause 7 of this International Standard or in any other Standard relating to B-QSIG to which the PINX claims conformance (e.g., a Standard specifying generic procedures for supplementary services).
- NOTE 4. The handling of national/private messages is outside the scope of this International Standard (see annex H).
- 4.3.36 unspecified bit rate (UBR):** an ATM service category for which no traffic-related service guarantees are specified.
- 4.3.37 virtual channel:** one of a number of multiplexed, bi-directional transfers of digital data provided by the ATM layer across an interface between two ATM switching points.
- 4.3.38 virtual channel connection:** a concatenation of virtual channels that extends between two points where the ATM adaptation layer is accessed.

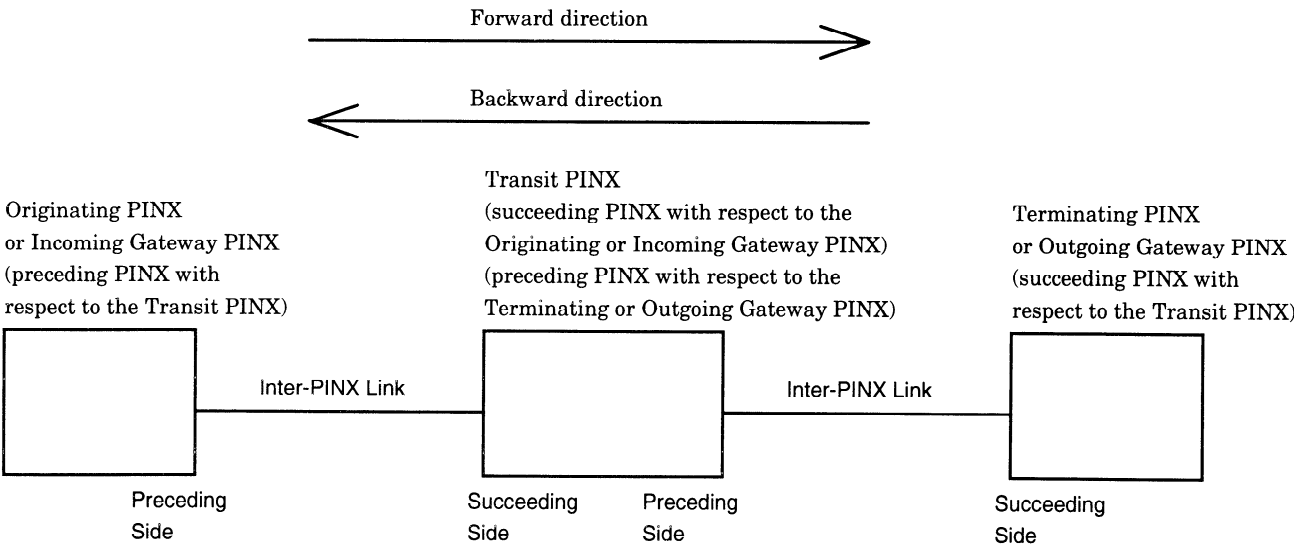


Figure 1 — Illustration of terminology through example of a call/connection routed over two inter-PINX links

5 List of acronyms

Abbreviations contained in section 2.1 of ATM Forum’s PNNI 1.0 are applicable with the following additions and/or

replacements:

ATC	ATM transfer capability
B-BC	Broadband bearer capability
B-HLI	Broadband high layer information
B-ISDN	Broadband ISDN
B-LLI	Broadband low layer information
B-PISN	Broadband PISN.
BCOB	Broadband Connection Orientated Bearer class
CCH	Call/connection handling
CPCS	Common Part Convergence Sublayer (of AAL)
DSS2	Digital Subscriber Signalling System Number 2
DTL	designated transit list
IE	Information Element
IPL	Inter-PINX Link
IPVC	Inter-PINX Virtual Channel
IPVCI	Inter-PINX Virtual Channel Identifier
IPVP	Inter-PINX Virtual Path
IPVPI	Inter-PINX Virtual Path Identifier
ISDN	Integrated Services Digital Network
MP	Mapping (functional grouping)
N-ISDN	Narrow-band ISDN
N-PISN	Narrow-band PISN
N-BC	Narrow-band bearer capability
N-HLC	Narrow-band high layer compatibility
N-LLC	Narrow-band low layer compatibility
OAM	Operations, Administration and Maintenance
PICS	Protocol Implementation Conformance Statement
PISN	Private Integrated Services Network
PINX	Private Services Network Exchange
PSS1	Private Signalling System Number 1
QOS	Quality Of Service
SDL	Specification and Description Language
SDU	Service Data Unit

6 General Principles

This International Standard specifies the layer 3 signalling procedures operating within the control plane for establishing, maintaining and clearing a broadband basic call/connection across an inter-PINX link (IPL). These signalling procedures are defined in terms of messages exchanged over a Signalling ATM Adaptation Layer (SAAL) connection within the signalling inter-PINX virtual channel (IPVC) of the IPL. The result of successful basic call/connection establishment is a virtual channel connection within the user plane for the purpose of user information transfer. This virtual channel connection uses an IPVC other than the signalling IPVC within the Inter-PINX link.

Conceptually, an IPL is attached to a PINX at the Q-reference point and comprises a signalling IPVC and one or more user information IPVCs. User information IPVCs are grouped into one or more inter-PINX virtual paths (IPVPs). A user

information IPVC is uniquely identified within the context of an IPL by the combination of its inter-PINX virtual path identifier (IPVPI) and its inter-PINX virtual channel identifier (IPVCI).

NOTE 5. For example, an IPVP might comprise those IPVCs that share a collective traffic capability through the intervening network.

In practice, these IPVCs are provided by an intervening network. The nature of the intervening network and the way it provides IPVCs are outside the scope of this International Standard.

NOTE 6. Examples of intervening network types include dedicated transmission systems, cross-connect networks and switched networks. Furthermore they can provide constant bit rate connections or ATM switching/cross-connection. The virtual path identity and virtual channel identity that appear in ATM cell headers at the interface between one of the PINXs and the intervening network need not equate to the IPVPI/IPVCI of the corresponding IPVC at the Q reference point.

An example of an IPL comprising a signalling IPVC and a number of user information IPVCs, the latter grouped into two IPVPs, is shown in Figure 2.

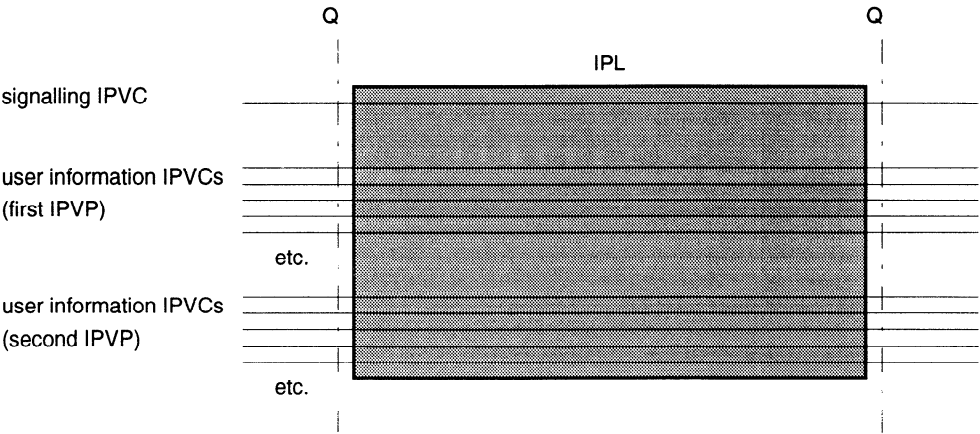


Figure 2 — Example of IPL provision

6.1 Protocol model

Figure 3 shows the relationship, within the control plane, between layer 3 and the adjacent layers.

The layer 3 entity within each PINX is known as Protocol Control, and this provides services to Call/Connection Handling (CCH). CCH handles each call/connection in accordance with the role of the PINX for that call/connection (e.g., Originating PINX, Transit PINX). The services of Protocol Control are accessed by means of primitives exchanged across the boundary between CCH and Protocol Control. Protocol Control provides the mapping between these primitives and the messages transferred across the IPL.

NOTE 7. CCH corresponds to "Call Control" in PNNI 1.0.

In order to transfer messages, Protocol Control uses the services of the Signalling ATM Adaptation Layer (SAAL). The SAAL uses the services of the ATM layer, which in turn uses the services of the physical layer.

This International Standard specifies the behaviour of Protocol Control. In addition, certain aspects of CCH are specified for various types of PINX: Transit PINX, Originating PINX, Terminating PINX, Incoming Gateway PINX and Outgoing Gateway PINX. The SAAL and ATM layer are outside the scope of this International Standard.

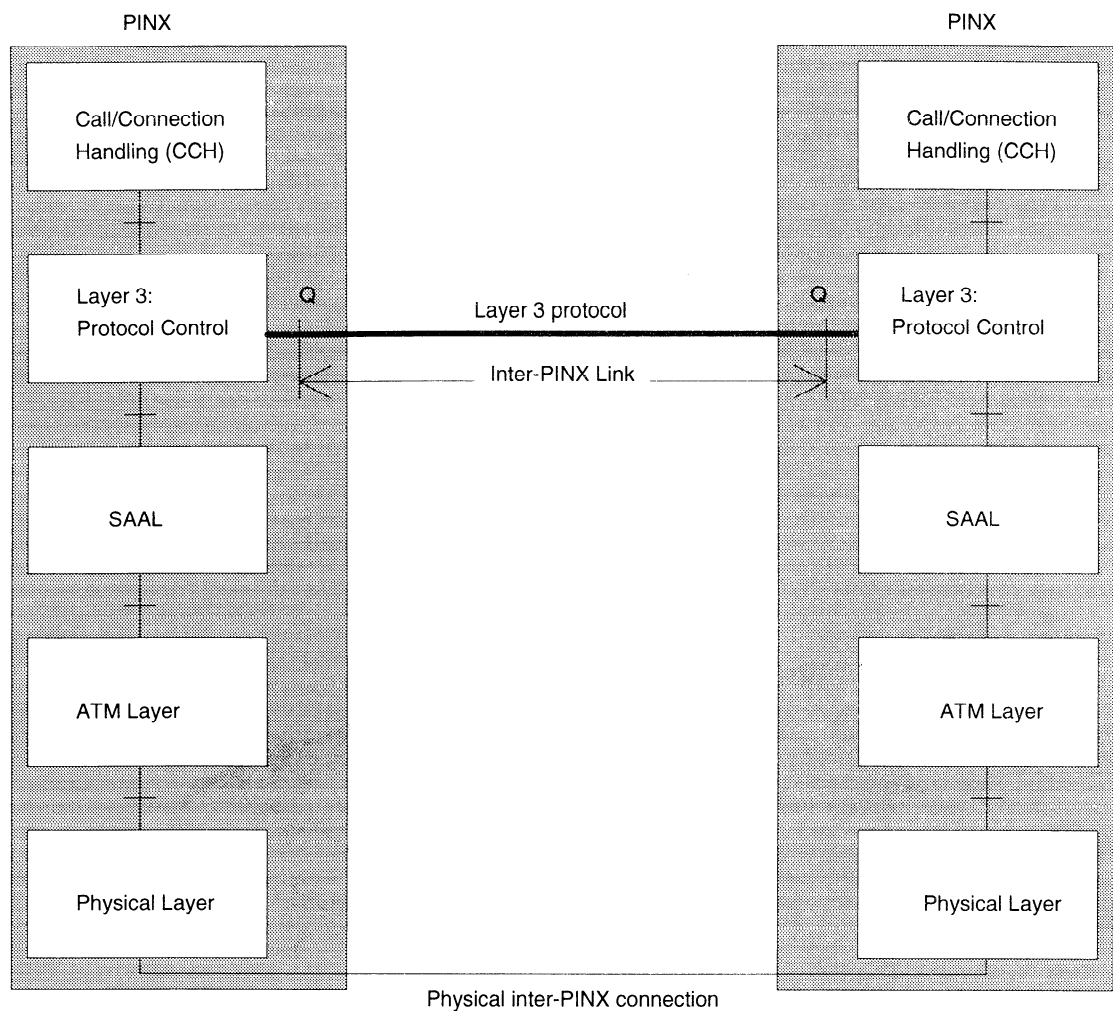


Figure 3 — Control plane protocol model

6.2 Services provided to CCH

Protocol Control provides services to CCH whereby CCH can send information flows to and receive information flows from a peer CCH. A primitive from CCH to Protocol Control of type "request" or "response" normally results in the associated information flow being presented to the peer CCH as a primitive of type "indication" or "confirmation" respectively. The following primitives are used:

- SETUP.Request/Indication/Response/Confirmation for the establishment of a call/connection;
- MORE_INFORMATION.Request/Indication for requesting more called party number information during call/connection establishment (for support of 64 kbit/s services only);
- INFORMATION.Request/Indication for providing more called party number information during call/connection establishment (for support of 64 kbit/s services only);
- PROCEED.Request/Indication for indicating that sufficient called party number information has been received and call/connection establishment is proceeding;
- ALERTING.Request/Indication for indicating that the called user is being alerted (for support of 64 kbit/s services only);
- PROGRESS.Request/Indication for indicating interworking conditions and/or the availability of in-band patterns (for support of 64 kbit/s services only);
- REJECT.Request/Indication for the immediate rejection of a call/connection;
- RELEASE.Request/Indication/Response/Confirmation for releasing a call/connection.
- NOTIFY.Request/Indication for the delivery of bearer-related notifications.

- STATUS.Request for causing the sending of a STATUS message.

6.3 Services required of the SAAL

The services required of the SAAL can be defined in terms of the services provided by the SAAL Service Specific Coordination Function specified in ISO/IEC 13246. Protocol Control uses the following SAAL services and their associated primitives:

- Assured transfer of data (for Protocol Control message transfer), using the AAL-DATA.request/indication primitives;
- SAAL connection establishment, using the AAL-ESTABLISH.request/indication/confirm primitives;
- SAAL connection release, using the AAL-RELEASE.indication primitive.

NOTE 8. Because the SAAL should normally remain established for the lifetime of the IPL, no procedures are specified for layer 3 to request SAAL connection release. Hence the AAL-RELEASE-Request and AAL-RELEASE-Confirmation primitives are not used.

6.4 Protocol Control states

Protocol Control procedures for calls/connections and restart are specified in terms of:

- messages which are transferred across the Inter-PINX link;
- primitives to and from the SAAL;
- the primitives to and from CCH at each PINX;
- the information processing and actions that take place within Protocol Control at each PINX; and
- the states that can exist within Protocol Control at each PINX.

A state machine is deemed to exist for each call/connection. Two further state machines are deemed to exist for restart initiation and restart response.

6.4.1 Call/connection states

Refer to section 6.2.1 of PNNI 1.0 for "ATM point-to-point call states".

6.4.2 Additional call/connection states relating to the provision of N-PISN services

6.4.2.1 Overlap Sending (NN2)

This state exists for an outgoing call/connection when the preceding side has received acknowledgement that the succeeding side is able to receive additional called party number information in overlap mode.

6.4.2.2 Overlap Receiving (NN25)

This state exists for an incoming call/connection when the succeeding side has sent acknowledgement to the preceding side that it is able to receive additional called party number information in overlap mode.

6.4.3 States for restart initiation

The states below are used in association with the global call reference for a side that initiates restart.

6.4.3.1 Null (Rest 0)

This state exists when there is no restart transaction initiated by this side and still in progress.

6.4.3.2 Restart Request (Rest 1)

This state exists when a restart transaction has been initiated from this side and is still in progress.

6.4.4 States for restart response

The states below are used in association with the global call reference for a side that responds to a restart request.

6.4.4.1 Null (Rest 0)

This state exists when there is no restart transaction initiated by the other side and still in progress.

6.4.4.2 Restart (Rest 2)

This state exists when a restart transaction has been initiated by the other side and is still in progress.

6.5 CCH states at a Transit PINX

The states below exist within CCH at a Transit PINX for each individual call/connection.

NOTE 9. These states are used in order to specify essential CCH requirements for a Transit PINX. These internal states are a descriptive tool and are not intended to constrain implementations.

6.5.1 TCC_Idle (0)

No call/connection exists.

6.5.2 TCC_Incoming_Call_Proceeding (4)

This state exists when CCH has determined that it has received all called party number information necessary to effect call/connection establishment and has informed the Preceding PINX, but no response to the request for call/connection establishment has been received from the Succeeding PINX.

6.5.3 TCC_Transit_Call_Proceeding (5)

This state exists when CCH has received from the Succeeding PINX a response to the request for call/connection establishment.

NOTE 10. In the case of N-PISN services, additional called party number information is no longer awaited from the Preceding PINX, i.e., overlap mode is not used or is complete.

6.5.4 TCC_Call_Alerting (6)

This state exists when CCH has received from the Succeeding PINX an indication that the called user is being alerted and has relayed the indication on to the Preceding PINX.

6.5.5 TCC_Call_Active (7)

This state exists when CCH has received from the Succeeding PINX and relayed on to the Preceding PINX an indication that the called user has answered the call.

NOTE 11. "answered" is the act of the end user accepting the call.

6.5.6 TCC_Await_Incoming_Release (8)

This state exists when CCH has initiated call/connection clearing towards the Preceding PINX and is awaiting an acknowledgement.

6.5.7 TCC_Await_Outgoing_Release (9)

This state exists when CCH has initiated call/connection clearing towards the Succeeding PINX and is awaiting an acknowledgement.

6.5.8 TCC_Await_Two-Way_Release (10)

This state exists when CCH has initiated call/connection clearing towards the Preceding PINX and towards the Succeeding PINX and is awaiting an acknowledgement from each.

6.6 Additional CCH states relating to the provision of N-PISN services at a Transit PINX**6.6.1 TCC_Await_Digits (1)**

This state exists when CCH has received a request for call/connection establishment from the Preceding PINX and is awaiting additional called party number information in order to select a route to the Succeeding PINX.

6.6.2 TCC_Await_Additional_Digits (2)

This state exists when CCH has sent a request for call/connection establishment to the Succeeding PINX and is awaiting possible additional called party number information from the Preceding PINX.

6.6.3 TCC_Overlap (3)

This state exists when CCH is awaiting possible additional called party number information from the Preceding PINX, having received acknowledgement that the Succeeding PINX is able to receive additional called party number information in overlap mode.

7 Message functional definitions and content

Refer to section 6.3 (excluding its subsections) of PNNI 1.0. The following modifications apply:

1. For each codeset 0 information element, either the subclause of this International Standard or the subsection of PNNI describing the information element is indicated.
2. The definitions of "incoming call/connection", "outgoing call/connection", "preceding side" and "succeeding side" in 4.3 apply.

NOTE 12. All messages may contain information elements from codesets 4, 5, 6 and 7 and corresponding Broadband locking shift and Broadband non-locking shift information elements which comply with the coding rules specified in 8.5.2 to 8.5.4. None of these information elements, however, are listed in this clause.

7.1 Messages for B-QSIG call/ connection control

Table 6-1 in 6.3.1 of PNNI 1.0 summarizes the messages for ATM point-to-point call/connection control. In addition, the message shown in Table 2 applies.

Table 2 — Additional message for ATM point-to-point call/connection control

Message	Reference
Call establishment messages: PROGRESS	7.1.8

7.1.1 ALERTING

Refer to section 6.3.1.1 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.
2. The additional content specified in Table 3 applies.

Table 3 — Additional ALERTING message content

Information element	Reference	Type	Length
Progress indicator	8.5.33	O	6

7.1.2 CALL PROCEEDING

Refer to section 6.3.1.2 of PNNI 1.0.

7.1.3 CONNECT

Refer to section 6.3.1.3 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.
2. The additional content specified in Table 4 applies.

Table 4 — Additional CONNECT message content

Information element	Reference	Type	Length
OAM traffic descriptor	8.5.32	O	6
Progress indicator	8.5.33	O	6

7.1.4 RELEASE

Refer to section 6.3.1.4 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.
2. The Crankback information element is not applicable.

7.1.5 RELEASE COMPLETE

Refer to section 6.3.1.5 of PNNI 1.0. The following modification applies:

1. The Crankback information element is not applicable.

7.1.6 SETUP

Refer to section 6.3.1.6 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.

- 2. The Designated transit list information element is not applicable.
- 3. The Connection identifier information element may be omitted only if the side sending the message is configured as the non-selecting side of the IPL.
- 4. The additional content specified in Table 5 applies.

Table 5 — Additional SETUP message content

Information element	Reference	Type	Length
Broadband sending complete	8.5.14	O	5 (NOTE)
OAM traffic descriptor	8.5.32	O	6
Progress indicator	8.5.33	O	6
NOTE. The Broadband sending complete information element is mandatory in the case of a B-PISN-specific service (i.e., not a 64 kbit/s-based PISN service).			

7.1.7 NOTIFY

Refer to section 6.3.1.9 of PNNI 1.0. The following modification applies:

- 1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.

7.1.8 PROGRESS

See Table 6.

This message is sent by the succeeding side to indicate the progress of a call/connection in the event of interworking or by either side in the call/connection with the provision of optional in-band information/patterns.

Table 6 — PROGRESS message content

Message type: PROGRESS			
Direction: both			
Significance: Global			
Information element	Reference	Type	Length
Protocol discriminator	6.4.2 of PNNI 1.0	M	1
Call reference	6.4.3 of PNNI 1.0	M	4
Message type	6.4.4.1 of PNNI 1.0	M	2
Message length	6.4.4.2 of PNNI 1.0	M	2
Cause	6.4.5.19 of PNNI 1.0	O (NOTE 3)	6-34
Notification indicator	6.4.5.27 of PNNI 1.0	O (NOTE 1)	5-*
Progress Indicator	8.5.33	M (NOTE 2)	6
NOTE 1. This information element may be present in order to deliver a notification. The Notification indicator information element may be repeated in a message. The maximum number of occurrences is implementation dependent.			
NOTE 2. This information element may occur up to three times.			
NOTE 3. Included if a call/connection failure has to be reported and inband tones/announcements are provided.			

7.2 Additional or modified messages related to the support of 64 kbit/s based PISN circuit-mode services

Table 6-2 in 6.3.2 of PNNI 1.0 summarizes the messages for ATM point-to-point call/connection control for the support of 64 kbit/s based PISN circuit-mode services. In addition, the messages shown in Table 7 apply.

Table 7 — Additional messages for the support of 64 kbit/s-based PISN circuit-mode services

Message	Reference
Call establishment messages: SETUP ACKNOWLEDGE	7.2.7
Miscellaneous messages: INFORMATION	7.2.6

7.2.1 ALERTING

Refer to section 6.3.2.1 of PNNI 1.0. The following modifications apply:

- 1. The modifications specified in 7.1.1 of this International Standard apply.
- 2. The Progress indicator information element may be repeated. The maximum number of occurrences is 3.

7.2.2 CONNECT

Refer to section 6.3.2.2 of PNNI 1.0. The following modifications apply:

- 1. The modifications specified in 7.1.3 of this International Standard apply.

2. The Progress indicator information element may be repeated. The maximum number of occurrences is 3.

7.2.3 **PROGRESS**

This message is as specified in 7.1.8 with the additional content specified in Table 8.

Table 8 — Additional PROGRESS message content

Information element	Reference	Type	Length
Narrow-band bearer capability	6.4.7.1 of PNNI 1.0	O	4-14
Narrow-band high layer compatibility	6.4.7.2 of PNNI 1.0	O	4-7

7.2.4 **RELEASE**

Refer to section 6.3.2.4 of PNNI 1.0. The following modifications apply:

- 1. The modifications specified in 7.1.4 of this International Standard apply.
- 2. The additional content specified in Table 9 applies.

Table 9 — Additional PROGRESS message content

Information element	Reference	Type	Length
Progress indicator	8.5.33	O	6 (NOTE)
NOTE. The Progress indicator information element may be repeated. The maximum number of occurrences is 3.			

7.2.5 **SETUP**

Refer to section 6.3.2.5 of PNNI 1.0. The following modifications apply:

- 1. The modifications specified in 7.1.6 of this International Standard apply.
- 2. The Progress indicator information element may be repeated. The maximum number of occurrences is 3.
- 3. The Broadband sending complete information element is optional.
- 4. The maximum number of occurrences of the Narrow-band high layer compatibility information element is 2.
- 5. The maximum number of occurrences of the Narrow-band low layer compatibility information element is 4.

7.2.6 **INFORMATION**

See Table 10.

This message is sent by the preceding side to provide additional information during call/connection establishment (in case of overlap sending).

Table 10 — INFORMATION message content

Message type: INFORMATION			
Direction: preceding to succeeding			
Information element	Reference	Type	Length
Protocol discriminator	8.2	M	1
Call reference	8.3	M	4
Message type	8.4	M	2
Message length	8.4	M	2
Broadband sending complete	8.5.14	O (NOTE)	4-5
Called party number	8.5.16	O (NOTE)	4-*
NOTE. Either the information element Broadband sending complete or the information element Called party number or both shall be present.			

7.2.7 **SETUP ACKNOWLEDGE**

See Table 11.

This message is sent by the succeeding side to the preceding side to indicate that call/connection establishment has been initiated, but additional information may be required.

Table 11 — SETUP ACKNOWLEDGE message content

Message type: SETUP ACKNOWLEDGE			
Direction: succeeding to preceding			
Information element	Reference	Type	Length
Protocol discriminator	8.2	M	1
Call reference	8.3	M	4
Message type	8.4	M	2
Message length	8.4	M	2
Connection Identifier	8.5.23	O (NOTE)	4-9
NOTE. This information element shall be included except where the Connection identifier information element in the SETUP message indicated «Exclusive IPVPI; exclusive IPVCI», in which case it shall be omitted.			

7.3 **Messages for point-to-multipoint call/connection control**

Additional messages for point-to-multipoint call/connection control are summarized in table 6-4 in 6.3.4 of PNNI 1.0.

7.3.1 **ADD PARTY**

Refer to section 6.3.4.1 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.
2. The Designated transit list information element is not applicable.
3. The additional content specified in Table 12 applies.

Table 12 — Additional ADD PARTY message content

Information element	Reference	Type	Length
Progress indicator	8.5.33	O	6

7.3.2 ADD PARTY ACKNOWLEDGE

Refer to section 6.3.4.2 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.
2. The additional content specified in Table 13 applies.

Table 13 — Additional ADD PARTY ACKNOWLEDGE message content

Information element	Reference	Type	Length
Progress indicator	8.5.33	O	6

7.3.3 PARTY ALERTING

Refer to section 6.3.4.3 of PNNI 1.0. The following modifications apply:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.
2. The additional content specified in Table 14 applies.

Table 14 — Additional PARTY ALERTING message content

Information element	Reference	Type	Length
Progress indicator	8.5.33	O	6

7.3.4 ADD PARTY REJECT

Refer to section 6.3.4.4 of PNNI 1.0. The following modification applies:

1. The Crankback information element is not applicable.

7.3.5 DROP PARTY

Refer to section 6.3.4.5 of PNNI 1.0. The following modification applies:

1. The Notification indicator information element may be repeated. The maximum number of occurrences is implementation dependent.

7.3.6 DROP PARTY ACKNOWLEDGE

Refer to section 6.3.4.6 of PNNI 1.0.

7.4 Messages used with the global call reference

Refer to section 6.3.3 of PNNI 1.0.

8 General message format and information elements coding

Refer to section 6.4 of PNNI 1.0.

8.1 Overview

Refer to section 6.4.1 of PNNI 1.0.

8.2 Protocol discriminator

Refer to section 6.4.2 of PNNI 1.0.

8.3 Call reference

Refer to section 6.4.3 of PNNI 1.0.

8.4 Message type, and message length

8.4.1 Message type

Refer to section 6.4.4.1 of PNNI 1.0. The following additional message types that are specified in 4.4.1 of Q.2931 but are not supported in PNNI 1.0 are supported in this International Standard:

SETUP ACKNOWLEDGE

INFORMATION

Escape to national or private specific message types is supported.

8.4.2 Message length

Refer to section 6.4.4.2 of PNNI 1.0.

8.5 Variable length information elements for B-ISDN environment

8.5.1 Coding rules

Refer to section 6.4.5.1 of PNNI 1.0 with the following changes:

The value "1111 1111" for the information element identifier is reserved for an extension mechanism, when all other information element identifier values are exhausted. This mechanism allows 65 536 additional information elements to be identified.

The information elements applicable to this International Standard are as shown in table 6-5 in 6.4.5.1 of PNNI 1.0 with the following modifications:

- 1. The maximum number of occurrences of a given information element in a message is message-dependent, as indicated in clause 7.
- 2. Additional information elements as specified in Table 15 apply.

Table 15 — Additional information elements

Bits	Information element	Max. Length
8 7 6 5 4 3 2 1		
0 1 0 1 1 0 1 1	OAM traffic descriptor	6
0 1 1 0 0 0 1 0	Broadband sending complete	5

8.5.2 Extensions of codesets

Refer to section 4.5.2 of ITU-T recommendation Q.2931. The following modifications apply:

- 1. "User or network equipment" shall be interpreted as "PINX".
- 2. Codeset 5 is outside the scope of this International Standard.
- 3. Codeset 6 and/or codeset 7 may be used for conveying non-standardized information between adjacent PINXs (e.g. for manufacturer or network specific purposes, see Annex H).
- 4. Information elements from codesets other than codeset 0 shall be handled according to the procedures for unrecognized information elements (see 6.5.6.8.1 of PNNI 1.0) unless recognized as relating to a future standardized or non-standardized capability.

8.5.3 Broadband-locking shift procedure

Refer to section 4.5.3 of ITU-T recommendation Q.2931. The following modifications apply:

- 1. Bit 4 of octet 2 shall have the meaning "pass along request".
- 2. The New Codest Identification field (bits 3 to 1 of octet 5) shall be encoded in accordance with Table 16.

Table 16 — Broadband-locking shift information element

- New Codeset identification (octet 5):		
Bits		
<u>3</u> <u>2</u> <u>1</u>		
0 0 0	not applicable	
0 0 1)	} reserved for future ITU-T use	
to 0 1 1)		
1 0 0	codeset 4: reserved for use by ISO/IEC standards	
1 0 1	codeset 5: outside the scope of this International Standard	
1 1 0	codeset 6: information elements for conveying non-standardized information	
1 1 1	codeset 7: information elements for conveying non-standardized information	

8.5.4 Broadband-non-locking shift procedure

Refer to section 4.5.4 of ITU-T recommendation Q.2931. The following modifications apply:

1. Bit 4 of octet 2 shall have the meaning "pass along request".
2. The New Codest Identification field (bits 3 to 1 of octet 5) shall be encoded in accordance with Table 16.

8.5.5 ABR additional parameters

Refer to section 6.4.5.5 of PNNI 1.0.

8.5.6 ABR setup parameters

Refer to section 6.4.5.6 of PNNI 1.0.

8.5.7 Alternative ATM traffic descriptor

Refer to section 6.4.5.7 of PNNI 1.0.

8.5.8 ATM adaptation layer parameters

Refer to section 6.4.5.8 of PNNI 1.0.

8.5.9 ATM traffic descriptor

Refer to section 6.4.5.9 of PNNI 1.0.

8.5.10 Broadband bearer capability

Refer to section 6.4.5.10 of PNNI 1.0.

8.5.11 Broadband high layer information (B-HLI)

Refer to section 6.4.5.11 of PNNI 1.0.

8.5.12 Broadband low layer information (B-LLI)

Refer to section 6.4.5.12 of PNNI 1.0.

8.5.13 Broadband repeat indicator

Refer to section 6.4.5.13 of PNNI 1.0.

8.5.14 Broadband sending complete

Refer to section 4.5.21 of ITU-T Recommendation Q.2931. The following modification applies:

1. The statement concerning the mandatory nature of this information element when operating in en bloc mode does not apply.
2. Bit 4 of octet 2 shall have the meaning "pass along request".

8.5.15 Call state

Refer to section 6.4.5.14 of PNNI 1.0 with the additional call state values in Table 17:

Table 17 — Call state information element

- Call/connection state value (octet 5)									
Bits									
6	5	4	3	2	1	state			
0	0	0	0	1	0	2	- Overlap sending		
0	1	1	0	0	1	25	- Overlap receiving		

8.5.16 Called party number

Refer to subclause 4.5.11 of ITU-T recommendation Q.2931. The following modifications apply:

- 1. Bit 4 of octet 2 shall have the meaning "pass along request".
- 2. If the use of ATM endsystem address encoded as NSAP address is not indicated in the addressing / numbering plan identification, the address/number digits appear in octet 6 and note 1 of the referenced subclause applies.
- 3. If the use of ATM endsystem address encoded as NSAP address is indicated in the addressing / numbering plan identification, the NSAP address octets appear in octet 6 and note 2 of the referenced subclause applies.
- 4. Only the type of number / numbering plan identification combinations shown in Table 18 shall be used.

Table 18 — Called party number information element

- Type of number (octet 5):

Bits 7 6 5	ISDN numbering plan	Private numbering plan	ATM endsystem address	unknown numbering plan
0 0 0	unknown (Note 2)	unknown (Note 2)	unknown (Note 2)	unknown (Note2)
0 0 1	international number (Note 1, Note 3)	level 2 regional number (Note 3)	reserved	reserved
0 1 0	national number (Note 1, Note 3)	level 1 regional number (Note 3)	reserved	reserved
0 1 1	reserved	B-PISN specific number	reserved	reserved
1 0 0	subscriber number (Note 1, Note 3)	level 0 regional number (Note 3)	reserved	reserved
1 1 0	reserved	reserved	reserved	reserved
1 1 1	reserved for extension	reserved for extension	reserved	reserved
All other values are reserved.				

Note 1 - For the definition of international, national and subscriber number, see Recommendation I.330.

Note 2 - The type of number "unknown" is used when ATM endsystem addressing or "unknown" is indicated in the addressing / numbering plan identification field or when the type of number is implicit in the address / number digits, e.g. through the use of prefix or escape digits.

Note 3 - Prefix digits shall not be included.

- Addressing / numbering plan identification (octet 5) :

Bits 4 3 2 1	
0 0 0 0	unknown (Note 1,2)
0 0 0 1	ISDN numbering plan (Recommendation E.164)
0 0 1 0	ATM endsystem address encoded as NSAP address (ISO/IEC 8348) (Note 3)
1 0 0 1	private numbering plan (ISO/IEC 11571) (Note 2)
1 1 1 1	reserved for extension
All other values are reserved.	

Note 1 - The numbering plan identification "unknown" indicates the numbering plan identity is implicit in the address /number digits, e.g., through the use of prefix or escape digits.

Note 2 - The use of this codepoint is a network option and requires bilateral agreement

Note 3 - If this codepoint is used, the type of number is coded as "unknown".

- Address / number digits (octets 6, etc., unless ATM endsystem addressing):

This field is coded with IA5 characters, according to the formats specified in the appropriate numbering/dialling plan.

- NSAP Address Octets (octets 6, etc. for NSAP addressing):

If the use of ATM endsystem address encoded as NSAP address is indicated in the addressing / numbering plan identification, the address is coded as described in ISO/IEC 8348 annex A. Any AFI value that denotes binary encoding may be used.

8.5.17 Called party subaddress

Refer to section 6.4.5.16 of PNNI 1.0.

8.5.18 Calling party number

Refer to subclause 4.5.13 of ITU-T recommendation Q.2931. The following modifications apply:

- 1. Bit 4 of octet 2 shall have the meaning "pass along request".
- 2. Octets 5 (but not 5a) and 6 shall be coded as specified for the Called party number information element in 8.5.16 of this International Standard.

8.5.19 Calling party subaddress

Refer to section 6.4.5.18 of PNNI 1.0.

8.5.20 Cause

Refer to section 6.4.5.19 of PNNI 1.0.

8.5.21 Connected number

Refer to section 6.4.5.20 of PNNI 1.0. The following modification applies.

1. Octets 5 (but not 5a) and 6 shall be coded as specified for the Called party number information element in 8.5.16 of this International Standard.

8.5.22 Connected subaddress

Refer to section 6.4.5.21 of PNNI 1.0.

8.5.23 Connection identifier

Refer to section 6.4.5.22 of PNNI 1.0. The following modifications apply:

The overall range of IPVCI values is 0 to 65535.

The range of IPVPI and IPVCI values available on an individual IPL will be determined at IPL establishment time.

8.5.24 Connection scope selection

Refer to section 6.4.5.23 of PNNI 1.0.

8.5.25 End-to-end transit delay

Refer to section 6.4.5.24 of PNNI 1.0.

8.5.26 Extended Quality of service (QOS) parameter

Refer to section 6.4.5.25 of PNNI 1.0.

8.5.27 Minimum acceptable ATM traffic descriptor

Refer to section 6.4.5.26 of PNNI 1.0.

8.5.28 Notification indicator

Refer to section 6.4.5.27 of PNNI 1.0 with the following changes as shown in Figure 4:

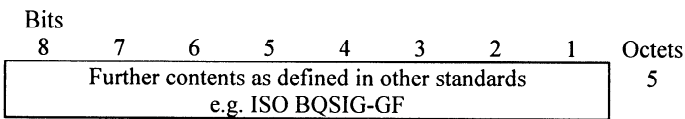


Figure 4 — Notification indicator information element

8.5.29 Quality of service (QOS) parameter

Refer to section 6.4.5.28 of PNNI 1.0.

8.5.30 Restart indicator

Refer to 4.5.20 of ITU-T recommendation Q.2931. The following modifications apply:

- 1. Bit 4 of octet 2 shall have the meaning "pass along request".
- 2. Table 4-20/Q.2931 is replaced by Table 19 below.

Table 19 — Restart indicator information element

- Class (octet 5)	
Bits	
3 2 1	
0 0 0	Indicated IPVC (Note 1)
0 0 1	All IPVCs in the indicated IPVP (Note 2)
0 1 0	All IPVCs controlled by the signalling IPVC (Note 3)
All other values are reserved.	
Note 1: The Connection identifier IE shall be included and shall indicate the IPVC to be restarted.	
Note 2: The Connection identifier IE shall be included and shall indicate the IPVP in which all IPVCs are to be restarted. The IPVCI field in the Connection identifier information element is ignored.	
Note 3: The Connection identifier IE shall not be included.	

8.5.31 Transit network selection

Refer to section 6.4.5.30 of PNNI 1.0.

8.5.32 OAM traffic descriptor

Refer to section 4.5.24 of ITU-T Recommendation Q.2931.

NOTE 13. The encoding of this information element is not specified in this International Standard for it is defined as transparent to this protocol, except for the shaping indicator field (octet 5).

8.5.33 Progress indicator

Refer to 8.5.32 of PNNI 1.0. The following modification applies:

- 1. Octets 5 onwards shall be encoded as specified in ISO/IEC 11572, subject to the restrictions given in Table 20.

Table 20 — Progress indicator information element

Coding standard (octet 5): Only the following coding is applicable.	
Bits	
7 6	
0 1	ISO/IEC standard
all other values reserved	
Progress description (octet 6): Only the following coding is applicable.	
Bits	
7 6 5 4 3 2 1	No
0 0 1 0 0 0 0	16 Interworking with public network
0 0 1 1 0 0 1	21 Delayed call completion

8.5.34 Calling party soft PVPC or PVCC

Refer to section 6.4.6.1 of PNNI 1.0.

8.5.35 Called party soft PVPC or PVCC

Refer to section 6.4.6.2 of PNNI 1.0.

8.6 Information Elements for the support of 64 kbit/s based ISDN circuit mode services

8.6.1 Narrow-band bearer capability

Refer to section 6.4.7.1 of PNNI 1.0 with the following changes as shown in Figure 5:

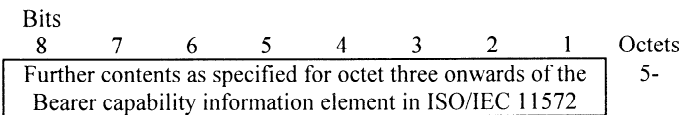


Figure 5 — Narrow-band bearer capability information element

8.6.2 Narrow-band high layer compatibility

Refer to section 6.4.7.1 of PNNI 1.0.

8.6.3 Narrow-band low layer compatibility

Refer to section 6.4.7.3 of PNNI 1.0.

8.6.4 Progress indicator

Refer to section 8.5.32 of PNNI 1.0 specification. The following modification applies:

- 1. Additional combinations of Coding Standard values and Progress Descriptions values apply, as specified for octets 3 and 4 of the Progress indicator information element in ISO/IEC 11572.

8.7 Information Elements for Point-to-Multipoint Call/connection control

Refer to 6.4.8 of PNNI 1.0.

9 Protocol control procedures for B-QSIG point-to-point calls/connections

This clause describes the general procedures for protocol control on either side of an IPL. Clause 11 specifies the particular features required to provide 64 kbit/s based circuit-mode ISDN services in B-PISN and to support signalling interworking between B-PISN and N-PISN or N-ISDN.

These procedures apply to a signalling IPVC that has already been established and are used to control B-PISN connections on the IPL concerned. Different connections controlled by the same signalling IPVC are distinguished

through different call reference values.

The call/connection states referred to in this clause are those perceived by the Protocol Control entity in a PINX at either side of the IPL.

Detailed Specification and Description Language (SDL) diagrams for the procedures specified in this clause are contained in annex D. When there is an ambiguity in the text, the SDL diagrams should be used to resolve the conflict. Where the text and the SDL are in disagreement, the text should be used as the prime source.

9.1 Establishment of a signalling AAL

Before these procedures are invoked, an assured mode signalling AAL connection must be established between the PINXs at either side of the IPL. All layer 3 messages shall be sent to the signalling AAL using the AAL-DATA.request primitive and received from the signalling AAL using the AAL-DATA.indication primitive.

Establishment of Signalling AAL connections is initiated as part of IPL establishment by transferring an AAL-ESTABLISH.request primitive to the signalling AAL.

On receipt of an AAL-ESTABLISH.confirm or AAL-ESTABLISH.indication primitive from the SAAL, inter-PINX signalling procedures may begin. The AAL-ESTABLISH.indication primitive will be received in the case of signalling AAL establishment requested by the peer Protocol Control entity, and the AAL-ESTABLISH.confirm primitive will be received in response to a local request to establish a signalling AAL connection.

9.2 Call/Connection establishment

Refer to section 6.5.2 (and its subsections) of PNNI 1.0. The following modifications apply:

1. The statement in 6.5.2.2 concerning the use of VPI=0/VCI=5 as the signalling virtual channel for use with non-associated signalling does not apply. The allocation of a signalling virtual channel is outside the scope of this International Standard.
2. Subsection 6.5.2.2.3 of PNNI 1.0 is not applicable.
3. The following mechanism replaces the use of node identifiers in 6.5.2.2.1, 6.5.2.2.2.1 and 6.5.2.2.2.2 of PNNI 1.0 as a means of avoiding call/connection collisions.

The two sides of an IPL may optionally be configured so that a single side is responsible for IPVPI/IPVCI selection for all call/connections in either direction. In this case, the side responsible for IPVCI selection is known as the selecting side and the other side is known as the non-selecting side. The selecting side shall use case b) of 6.5.2.2.1, case b) of 6.5.2.2.2.1 or case d) of 6.5.2.2.2.2 of PNNI 1.0 when transmitting a SETUP message. A non-selecting side shall use case a) of 6.5.2.2.1, case a) or case c) of 6.5.2.2.2.1 or case c) of 6.5.2.2.2.2 of PNNI 1.0 when transmitting a SETUP message.

NOTE 14. Call/connection collisions can still occur if the optional configuration of a selecting side and a non-selecting side is not employed or in the case of misconfiguration.

4. All references to the Crankback information element are not applicable..
5. The procedures in 9.2.1 below for the handling of the PROGRESS message apply.
6. The procedures in 9.2.2 below for the call/connection failure replace the procedures of 6.5.2.7 of PNNI 1.0.

9.2.1 Handling of a PROGRESS message

During state Incoming Call Proceeding or Call Received, in order to send a progress description in a Progress indicator information element when no ALERTING or CONNECT message is to be sent at the same time, the succeeding side may send a PROGRESS message. No state change shall occur on sending a PROGRESS message.

On receipt of a PROGRESS message during state Outgoing Call Proceeding or Call Delivered, no state change shall occur. If the Progress indicator information element in the PROGRESS message contains progress description 21 and timer T310 is running (state Outgoing Call Proceeding only), timer T310 shall be stopped.

9.2.2 Call/connection failure

If the succeeding side determines that the call/connection cannot proceed, then the succeeding side shall initiate call/connection clearing in accordance with 9.3. The following are examples of causes that can be used:

- #1 "unassigned (unallocated) number";
- #3 "no route to destination";
- #17 "user busy";
- #18 "no user responding";

- #19 "no answer from user";
- #21 "call rejected";
- #22 "number changed";
- #28 "invalid number format (address incomplete)";
- #47 "resources unavailable, unspecified" (e.g., unable to provide the indicated peak cell rate);
- #49 "quality of service not available" (e.g., unable to provide the requested QOS class or unable to accept the requested maximum transit delay);
- #57 "bearer capability not authorized";
- #58 "bearer capability not presently available";
- #63 "service or option not available, unspecified";
- #65 "bearer service not implemented".

In particular the succeeding side shall initiate call/connection clearing with cause #65 "bearer service not implemented" if the Broadband bearer capability information element in the SETUP message contains a value that is not specified in 8.5.10 or is not implemented in any of the following fields:

- Bearer class;
- ATM transfer capability;
- Susceptibility to clipping;
- User plane connection configuration.

9.3 Call/Connection clearing

Refer to section 6.5.3 of PNNI 1.0. The following modification applies:

1. Crankback does not apply.

9.4 Call/connection collisions

Refer to section 6.5.4 of PNNI 1.0. The following modification applies:

1. The Crankback information element does not apply.

9.5 Restart procedure

Refer to section 6.5.5 of PNNI 1.0.

9.6 Handling of error conditions

Refer to section 6.5.6 of PNNI 1.0. The following modifications apply:

1. Information element error procedures may also apply to information elements in codesets other than 0. In that case, the diagnostics in the Cause information element may indicate information elements other than those in codeset 0 by applying the locking or non-locking shift procedures as described in 8.5.
2. The last two paragraphs of 6.5.6.8.1 of PNNI 1.0 relating to the Broadband-locking shift IE and Broadband-non-locking shift information elements are not applicable for B-QSIG.
3. The procedures of 9.6.1 below for sending a STATUS message apply.
4. The procedures of 9.6.2 below for determining state compatibility on receipt of a STATUS message that does not contain the global call reference apply in addition to the procedures of 6.5.6.12 of PNNI 1.0.

9.6.1 Sending a STATUS message

In addition to the circumstances specified elsewhere in this International Standard for sending a STATUS message, a STATUS message may be sent at any other time to indicate the state associated with a call reference.

9.6.2 Determination of protocol state compatibility on receipt of a STATUS message containing a call reference other than the global call reference

On receipt of a STATUS message containing a call reference value other than the global call reference, the receiving entity shall check whether the protocol control state reported in the STATUS message is compatible with the state associated with that call reference internally. Table 21 indicates which protocol control states shall be considered compatible. However, this table does not imply that all other pairs of states are to be considered incompatible.

Table 21 — Compatible protocol control states

Internal protocol control state associated with call reference	Reported protocol control state in STATUS message
NN0 - Null	NN0 - Null
NN1 - Call Initiated	NN6 - Call Present
NN2 - Overlap Sending	NN25 - Overlap Receiving
NN3 - Call Proceeding Sent	NN9 - Call Proceeding Received
NN4 - Alerting Delivered	NN7 - Alerting Received
NN6 - Call Present	NN1 - Call Initiated
NN7 - Alerting Received	NN4 - Alerting Delivered
NN9 - Call Proceeding Received	NN3 - Call Proceeding Sent
NN10 - Active	NN10 - Active
NN11 - Release Request	NN11 - Release Request NN12 - Release Indication
NN12 - Release Indication	NN11 - Release Request
NN25 - Overlap Receiving	NN2 - Overlap Sending

9.7 Error procedures with explicit action indication

Refer to 6.5.7 of PNNI 1.0.

9.8 Handling of messages with insufficient information

Refer to section 6.5.8 of PNNI 1.0.

9.9 Notification procedures

Refer to section 6.5.10 of PNNI 1.0.

9.10 Notification of interworking

Refer to section 6.5.11 of PNNI 1.0.

9.11 List of Timers

Refer to section 6.5.12 of PNNI 1.0. The following clarifications apply:

1. On the first expiry of T303, as an alternative to restarting T303 and retransmitting the SETUP message, this may be treated as the final expiry of T303.
2. T316 is mandatory.
3. T317 is mandatory.

The following modifications apply:

1. T310 shall also be stopped on receipt of a PROGRESS message containing progress description 1, 2, 8 or 21.
2. The additional timers in Table 22 apply.

Table 22 — Additional protocol timer definitions for the support of 64 kbit/s circuit basic mode services.

Timer number	Default value	Call state	Cause for start	Cause for normal stop	Action to be taken when timer expires	Implementation
T302	15 s	Overlap receiving	Sending of SETUP ACK. Restarted on receipt of each INFORMATION message.	On the sending of CALL PROCEEDING	Clear call/connection if information is definitely incomplete, else send CALL PROCEEDING	M
T304	30 s	Overlap sending	SETUP ACK received. Restarted on sending of each INFORMATION message.	Receiving CALL PROCEEDING	Clear the call/connection	M

10 Call/connection Control Procedures for Point-to-Multipoint Calls

Refer to section 6.6 of PNNI 1.0. The following clarification applies:

- 1. The CONNECT ACK message and the Connect Request state are not applicable.

The following modifications apply:

- 1. Crankback procedures and the Crankback information element are not applicable.
- 2. Support of point-to-multipoint call/connections is optional.

Detailed Specification and Description Language (SDL) diagrams for the procedures specified in this clause are contained in annex K. When there is an ambiguity in the text, the SDL diagrams should be used to resolve the conflict. Where the text and the SDL are in disagreement, the text should be used as the prime source.

11 Procedures for the support of 64 kbit/s based circuit mode basic services in B-PISN and interworking between N-PISNs and B-PISNs

This clause specifies the particular features required to provide 64 kbit/s based circuit-mode basic services ("N-PISN services") in B-PISNs and to support interworking between B-PISNs and N-PISNs. N-PISN services are the services defined in ISO/IEC 11574 and ISO/IEC 11584 and supported by the QSIG (PSS1) signalling protocol specified in ISO/IEC 11572. For these services interworking with N-PISNs is possible.

NOTE 15. Interworking functions to support packet and frame mode bearer services are not in the scope of this International Standard.

11.1 Introduction

The procedures defined in this International Standard are based on the principle that there is no difference between the provision of N-PISN services in a pure B-PISN environment and the provision of these services in the case of interworking with an N-PISN.

Separate service-related information elements are defined for N-PISN services and for B-PISN services. For the provision of N-PISN services, the information elements Narrow-band bearer capability (N-BC), Narrow-band low layer compatibility (N-LLC) and Narrow-band high layer compatibility (N-HLC) are specified in clause 8.

Table 23 shows the information elements required for the provision of N-PISN services in B-PISNs.

Table 23 — Information elements to provide N-PISN services

	Information elements used to describe network relevant bearer attributes	Information elements used to describe lower layer attributes (transparent for the B-PISN)	Information elements used to describe high layer attributes
N-PISN related information elements	Narrow-band bearer capability (N-BC)	Narrow-band low layer compatibility (N-LLC)	Narrow-band high layer compatibility (N-HLC)
B-PISN related information elements	– Broadband bearer capability (B-BC) – ATM traffic descriptor – QOS parameter – End-to-end transit delay (optional)	– ATM adaptation layer parameters (AAL parameters) – OAM traffic descriptor (optional)	–

11.2 describes the use of N-PISN service-related information elements. 11.3 and 11.4 specify the interworking functions between B-PISNs and N-PISNs.

11.2 Use of information elements for N-PISN services

11.2.1 General aspects

When N-PISN services are requested in a B-PISN environment, the information elements defined in 8.5 are used in the same manner as for B-PISN specific services. Additionally, the information elements defined in 8.5.34 are used for the provision of the N-PISN services as described below.

The following subclauses (11.2.2 to 11.2.4) only describe the use of the service-related information elements in the SETUP message. However, in the case of service negotiation they may also be included in a suitable response message returned to the call initiating entity.

11.2.2 Bearer service related information

The B-BC information element shall always be included in the SETUP message. This information is interpreted by the B-PINX. For N-PISN services, the N-BC information element shall also be included in the SETUP message. Unlike the B-BC information element, however, the N-BC information element need only be interpreted when there is a possibility of providing tones/announcements according to 11.7.1.

The coding of the Broadband bearer capability information element shall be as shown in Table 24.

Table 24 — Coding of the Broadband bearer capability information element

Octet	Information element field	Field value
5	Bearer class	BCOB-A
6	Susceptibility to clipping	susceptible to clipping
	User plane connection configuration	point-to-point

The ATM traffic descriptor information element shall always be included in the SETUP message. For N-PISN services, a value for the ATM user cell rate shall be selected such that the bit rate of the N-PISN service (64 kbit/s or n x 64 kbit/s) can be transported as the cell payload of the ATM cells, i.e. excluding the overhead of the ATM cell and the AAL header.

When AAL1 is used, the coding of the ATM traffic descriptor information element for N-BC information transfer rate of 64 kbit/s shall be as shown in Table 25.

Table 25 — Coding of the ATM traffic descriptor information element for 64 kbit/s using AAL1

Octet	Information element field	Field value if no OAM cells are used (NOTE 1)	Field value if 1 OAM cell/s is used (NOTE 2)	Field value with maximal OAM support (NOTE 3)
7.1	Forward peak cell rate (CLP=0+1)	0000 0000	0000 0000	0000 0000
7.2		0000 0000	0000 0000	0000 0000
7.3		1010 1011 (171 cells/s)	1010 1100 (172 cells/s)	1010 1111 (175 cells/s)
8.1	Backward peak cell rate (CLP=0+1)	0000 0000	0000 0000	0000 0000
8.2		0000 0000	0000 0000	0000 0000
8.3		1010 1011 (171 cells/s)	1010 1100 (172 cells/s)	1010 1111 (175 cells/s)
NOTE 1: These values are based on an AAL type 1 payload of 47 octets per cell (i.e. no partially filled cell) for user information and no cell rate allocation for OAM cells.				
NOTE 2: These values are based on an AAL type 1 payload of 47 octets per cell (i.e. no partially filled cell) for user information and on 1 cell/s allocation for OAM cells.				
NOTE 3: These values are based on an AAL type 1 payload of 47 octets per cell (i.e. no partially filled cell) for user information and the following cell rate allocation for OAM: two percent of the user cell rate and an additional 1 cell/s.				
NOTE 4: Octet groups 5, 6 and 9 onwards shall not be used.				

When AAL5 is used, the coding of the ATM traffic descriptor information element for N-BC information transfer rate of 64 kbit/s shall be as shown in Table 26.

Table 26 — Coding of the ATM traffic descriptor information element for 64 kbit/s using AAL5

Octet	Information element field	Field value if no OAM cells are used (NOTE 1)	Field value if 1 OAM cell/s is used (NOTE 2)	Field value with maximal OAM support (NOTE 3)
7.1	Forward peak cell rate (CLP=0+1)	0000 0000	0000 0000	0000 0000
7.2		0000 0000	0000 0000	0000 0000
7.3		1100 1000 (200 cells/s)	1100 1001 (201 cells/s)	1100 1101 (205 cells/s)
8.1	Backward peak cell rate (CLP=0+1)	0000 0000	0000 0000	0000 0000
8.2		0000 0000	0000 0000	0000 0000
8.3		1100 1000 (200 cells/s)	1100 1001 (201 cells/s)	1100 1101 (205 cells/s)
NOTE 1: These values are based on an AAL type 5 payload of 40 octets per cell for user information and no cell rate allocation for OAM cells. For a payload of less than 40 octets, the field value shall be $8000 \div \text{payload_length}$, encoded in binary format.				
NOTE 2: These values are based on an AAL type 5 payload of 40 octets per cell for user information and on 1 cell/s allocation for OAM cells. For a payload of less than 40 octets, the field value shall be $8000 \div \text{payload_length} + 1$, encoded in binary format.				
NOTE 3: These values are based on an AAL type 5 payload of 40 octets per cell for user information and the following cell rate allocation for OAM: two percent of the user cell rate and an additional 1 cell/s. For a payload of less than 40 octets, the field value shall be $8000 \div \text{payload_length} \times 1.02 + 1$, encoded in binary format.				
NOTE 4: Octet groups 5, 6 and 9 onwards shall not be used.				

When AAL1 is used, coding of the ATM traffic descriptor information element for N-BC information transfer rate of n x 64 kbit/s shall be as shown in Table 27.

Table 27 — Coding of the ATM traffic descriptor information element for n x 64 kbit/s using AAL1

Octet	Information element field	Field value if no OAM cells are used	Field value if 1 OAM cell/s is used	Field value with maximal OAM support
7.1 7.2 7.3	Forward peak cell rate (CLP=0+1)	nx8000/47 rounded up to the next integer value	(nx8000/47) + 1 rounded up to the next integer value	((nx8000/47)x1,02) + 1 rounded up to the next integer value
8.1 8.2 8.3	Backward peak cell rate (CLP=0+1)	nx8000/47 rounded up to the next integer value	(nx8000/47) + 1 rounded up to the next integer value	((nx8000/47)x1,02) + 1 rounded up to the next integer value

When AAL5 is used, coding of the ATM traffic descriptor information element for N-BC information transfer rate of n x 64 kbit/s shall be as shown in Table 28.

Table 28 — Coding of the ATM traffic descriptor information element for n x 64 kbit/s using AAL5

Octet	Information element field	Field value if no OAM cells are used	Field value if 1 OAM cell/s is used	Field value with maximal OAM support
7.1 7.2 7.3	Forward peak cell rate (CLP=0+1)	nx8000/40 rounded up to the next integer value	(nx8000/40) + 1 rounded up to the next integer value	((nx8000/40)x1,02) + 1 rounded up to the next integer value
8.1 8.2 8.3	Backward peak cell rate (CLP=0+1)	nx8000/40 rounded up to the next integer value	(nx8000/40) + 1 rounded up to the next integer value	((nx8000/40)x1,02) + 1 rounded up to the next integer value
NOTE: For a payload of less than 40 octets, '40' in the above formulae shall be replaced by the payload length				

The Quality of service parameter information element shall always be included in the SETUP message, indicating the unspecified QOS class.

The coding of the QOS parameter information element shall be as shown in Table 29.

Table 29 — Coding of the QOS parameter information element

Octet	Information element field	Field value
5	QOS-class forward	unspecified QOS class
6	QOS-class backward	unspecified QOS class

The End-to-end transit delay information element may be included in the SETUP message and coded according to 8.5.25.

The OAM traffic descriptor information element may be included in the SETUP message and coded according to 8.5.32.

11.2.3 Low layer related information

If available, the N-LLC information element shall be included in the SETUP message. The rules for the use of low layer related information are outside the scope of this International Standard.

No B-LLI information element shall be included.

The ATM adaptation layer parameters information element shall be included in the SETUP message, specifying the AAL type to be used.

The coding of the AAL parameters information element for 64 kbit/s unrestricted digital information and 64 kbit/s restricted digital information using AAL1 shall be as shown in Table 30.

Table 30 — Coding of the AAL parameters information element for 64 kbit/s unrestricted digital information and 64 kbit/s restricted digital information

Octet	Information element field	Field value
5	AAL-Type	0000 0001 (AAL Type 1)
6.1	Subtype	0000 0010 (circuit transport)
7.1	CBR Rate	0000 0001 (64 kbit/s)
9.1	Source Clock Frequency	0000 0000 (Null) (NOTE)
10.1	Error Correction method	0000 0000 (Null) (NOTE)
NOTE. These fields may also be absent.		

The coding of the AAL parameters information element for speech and 3,1 kHz audio information transfer capabilities using AAL1 shall be as shown in Table 31.

Table 31 — Coding of the AAL parameters information element for speech and 3,1 kHz audio information transfer capabilities

Octet	Information element field	Field value
5	AAL-Type	0000 0000 (AAL for voice) (NOTE)
NOTE. AAL for voice is a simplified AAL type 1, where synchronous circuit transport (no SRTS), no SDT pointer, no error correction method, and no partially filled cells method are used (see ITU-T Recommendation I.363).		

The coding of the AAL parameters information element for n x 64 kbit/s information transfer rate using AAL1 shall be as shown in Table 32.

Table 32 — Coding of the AAL parameters information element for n x 64 kbit/s

Octet	Information element field	Field value
5	AAL-Type	0000 0001 (AAL Type 1)
6.1	Subtype	0000 0010 (circuit transport)
7.1	CBR Rate	0100 0000 (nx64 kbit/s)
8.1, 8.2	Multiplier	xxxx xxxx xxxx xxxx (2 ... 65.535)
9.1	Source Clock Frequency	0000 0000 (Null) (NOTE)
10.1	Error Correction method	0000 0000 (Null) (NOTE)
NOTE. These fields may also be absent.		

The coding of the AAL parameters information element when using AAL5 shall be as shown in Table 33.

Table 33 — Coding of the AAL parameters information element for n x 64 kbit/s

Octet	Information element field	Field value
5	AAL-Type	0000 0101 (AAL Type 5)
6.1 6.2	Forward maximum CPCS-SDU size	Any value in the range 1 to 40, encoded in binary format
7.1 7.2	Backward maximum CPCS-SDU size	Any value in the range 1 to 40, encoded in binary format
8 8.1	SSCS-type	Absent (preferred) or 0000 0000 null

11.2.4 Higher layer related information

If available, the N-HLC information element shall be included in the SETUP message. The rules for the use of higher layer related information are outside the scope of this International Standard.

No B-HLI information element shall be included.

11.2.5 Handling of inconsistent combination of service parameters

If the PINX detects an inconsistent combination of broadband and narrow-band service parameters, it may clear the call with cause No. 63 *Service or option not available, unspecified*.

11.3 Interworking PINX procedures for the succeeding side

This subclause specifies the protocol control functions to be performed by an Interworking PINX in the case of a call originated in an N-PISN. Examples of the mapping of codepoints are given in annex C.

11.3.1 Mapping of service related information

The information elements Bearer capability, Low Layer Compatibility, if present, and High Layer Compatibility, if

present, shall be mapped to the information elements N-BC, N-LLC and N-HLC, respectively, such that octets 3 onwards of the former are equal to octets 5 onwards of the latter. The Flag bit in the second octet shall be set to "0", i.e. the normal error handling procedures as defined in 9.6 apply.

In addition to the N-BC information element, the B-BC information element shall be generated by the Interworking PINX.

The ATM traffic descriptor and the QOS parameter information elements shall also be generated by the Interworking PINX.

The End-to-end transit delay information element and the OAM traffic descriptor information element may be generated.

The AAL parameters information element shall be generated by the Interworking PINX, indicating the AAL-type used.

An N-PISN service-related information element received in a backward message shall be mapped according to 11.4.2.

11.3.2 Mapping of cause information

A Cause information element received from the N-PISN shall be mapped to the corresponding Cause information element by the Interworking PINX such that octets 5 onwards are equal to octets 3 onwards of the N-PISN information element.

The Flag bit in the second octet shall be set to "0", i.e. the normal error handling procedures as defined in 9.6 apply.

A Cause information element received from the B-PISN shall be mapped according to 11.4.3.

11.4 Interworking PINX procedures for the preceding side

This subclause specifies the protocol control functions to be performed by an Interworking PINX in the case of a call leaving the B-PISN towards an N-PISN.

11.4.1 General aspects

If a B-PISN specific service is selected for a call to be routed towards an N-PISN, then the call shall be rejected by the Interworking PINX with cause No. 63 *Service or option not available, unspecified*.

11.4.2 Mapping of service related information

The B-BC, the ATM traffic descriptor, the QOS parameter, the End-to-end transit delay and the OAM traffic descriptor information elements shall be discarded by the Interworking PINX.

The information elements N-BC, N-LLC, if present, and N-HLC, if present, shall be mapped to the corresponding N-PISN information elements such that octets 3 onwards of the latter are equal to octets 5 onwards of the former.

If no N-BC information element is included in the SETUP message, then a B-PISN service shall be assumed and the call shall be rejected according to 11.4.1.

The AAL parameter information element shall be discarded by the Interworking PINX.

An N-PISN service-related information element received in a backward message shall be mapped according to 11.3.1.

11.4.3 Mapping of cause information

For the mapping of the B-PISN Cause information element to the corresponding QSIG Cause information element the following rules shall apply.

- a) Any broadband specific cause value where there is no equivalent value in the QSIG protocol shall be mapped to the *unspecified* value of the same class, e.g. the B-PISN cause values:
 - *Requested VPCI/VCI not available*
 - *VPCI/VCI assignment failure*
 - *User cell rate not available* and
 - *No VPCI/VCI available*
 - are mapped to the QSIG cause value 47 *Resource unavailable, unspecified*;
 - *Unsupported combination of traffic parameters*
 - is mapped to the QSIG cause value 79 *Service or option not implemented, unspecified*; and
 - *AAL parameters cannot be supported*

- is mapped to the QSIG cause value 95 *Invalid message, unspecified*.
- b) Any cause value and diagnostic used in both protocols shall not be changed by the Interworking PINX.
- c) If any cause value used in the B-PISN protocol is received by the Interworking PINX for which a diagnostic field may be present (e.g. cause value 82) while the same cause value of the QSIG protocol does not allow for a diagnostic field, then the Interworking PINX shall discard the diagnostic field and leave the cause value unchanged.

A Cause information element received from the N-PISN shall be mapped according to 11.3.2.

11.5 Overlap sending

11.5.1 Preceding side procedures

Overlap sending may be supported at the preceding side of an inter-PINX link.

When a SETUP ACKNOWLEDGE message is received, the preceding side shall: stop timer T303; start timer T304; enter the Overlap Sending state; and send the remainder of the called party number (if any) in one or more INFORMATION messages, (re-)starting timer T304 when each INFORMATION message is sent.

The called party number information shall be provided in the Called party number information element.

An INFORMATION message may contain a Broadband sending complete information element, in addition to or instead of a Called party number information element.

NOTE 16. It is recommended that the preceding side inserts the Broadband sending complete information element in the INFORMATION message if the preceding side can determine that this message contains the last digit(s) of the called party number.

At the expiration of timer T304 the preceding side shall initiate call clearing to the succeeding side in accordance with 9.3 with cause No. 102 *recovery on timer expiry* and indicate call failure with cause 28 *invalid number format (incomplete number)* to call/connection handling.

NOTE 17. This will result in clearing with cause 28 towards the calling user.

11.5.2 Succeeding side procedures

Overlap sending shall be supported at the succeeding side of an inter-PINX link.

When the succeeding side determines that a received SETUP message contains either:

- a) incomplete called number information, or
- b) called number information which the succeeding side cannot determine to be complete,

the succeeding side shall: start timer T302; send a SETUP ACKNOWLEDGE message to the preceding side; and enter the Overlap Receiving state.

The succeeding side shall (re-)start timer T302 on receipt of every INFORMATION message not containing a Broadband sending complete information element.

Following the receipt of a Broadband sending complete information element, or the determination that sufficient call information has been received, the succeeding side shall stop timer T302 and send a CALL PROCEEDING message to the preceding side. Alternatively, depending on internal events, the succeeding side may send an ALERTING or CONNECT message to the preceding side.

At the expiration of timer T302 the succeeding side shall either:

- a) send a CALL PROCEEDING, ALERTING or CONNECT message as appropriate if sufficient information has been received; or
- b) initiate clearing in accordance with 9.3 with cause No.28 *invalid number format (incomplete number)* if it determines that the call information is definitely incomplete.

If, following the receipt of a SETUP message or during overlap sending, the succeeding side determines that the received call information is invalid (e.g. invalid called party number), it shall initiate call clearing in accordance with 9.3 with a cause such as one of the following:

- 1 Unassigned (unallocated) number;
- 3 No route to destination;
- 22 Number changed
- 28 Invalid number format (incomplete number).

11.6 Notification of interworking

The QSIG-Progress indicator information element shall be mapped to the B-PISN-Progress indicator information element and vice versa, such that octet 3 of the former is equal to octet 5 of the latter.

A Progress indicator information element included in a call control message shall not change the processing of that message. If the Progress indicator information element is included in the PROGRESS message, no state change shall occur but the PINX shall stop timer T310 if the progress description is No. 1, No. 2, or No. 8.

11.7 Tones and announcements

11.7.1 Tones and announcements during call establishment

Tones and announcements may be provided by the succeeding side only if the N-BC information element is present and indicates *Speech, 3.1 kHz audio or Unrestricted digital information with tones and announcements*. When providing tones or announcements, the succeeding side shall send a Progress indicator information element with progress description No. 8 *In-band information or appropriate pattern now available* in a suitable call control message or a PROGRESS message to the preceding side.

NOTE 18. Call/connection handling will through-connect the user plane virtual channel (at least) in backward direction (if not done already) upon receipt of progress description No. 8.

Traffic and protocol parameters indicated in the SETUP message shall be used for the transmission of tones and announcements.

NOTE 19. Tones and announcements generated in a non-B-PISN are converted into ATM cells (using AAL type for voice) at the Interworking PINX. Tones and announcements generated in the B-PISN are converted into the 64 kbit/s stream at the Interworking PINX.

11.7.2 Clearing when tones and announcements are provided

When in-band tones/announcements are provided by the succeeding side in the course of call clearing, a PROGRESS message may be sent, containing a Cause information element and a progress indicator No. 8 *In-band information or appropriate pattern now available*. Sending of the PROGRESS message is optional in the Active state but mandatory in the other call states.

On receipt of a PROGRESS message with a Cause information element and a progress indicator No. 8, the preceding side shall inform call/connection handling.

NOTE 20. The call/connection handling at the preceding PINX will either through-connect (if not already done) the user plane virtual channel or immediately start call/connection clearing according to 9.3. If call/connection clearing has not occurred after providing the tone/announcement for a sufficient time, the PINX providing the tone/announcement may initiate clearing according to 9.3.

12 Call/connection handling requirements

12.1 Transit PINX call/connection handling requirements

NOTE 21. The provision of Transit PINX functionality is an option. When provided, the procedures contained herein are mandatory.

This clause specifies those aspects of call/connection handling at a Transit PINX that are necessary for coordinating the Succeeding Side and Preceding Side protocol entities.

These procedures refer to the Preceding PINX and the Succeeding PINX. These PINXs are either side of Transit PINX. This terminology is used in order to clarify the text. The adjectives (Preceding / Succeeding) only have meaning when used in the context of a particular call/connection. The call/connection attempt will have passed from the Preceding PINX, through the Transit PINX, to the Succeeding PINX.

Figure 6 shows the conceptual relationship between the Call/Connection Handling and Succeeding and Preceding Protocol Control within a Transit PINX.

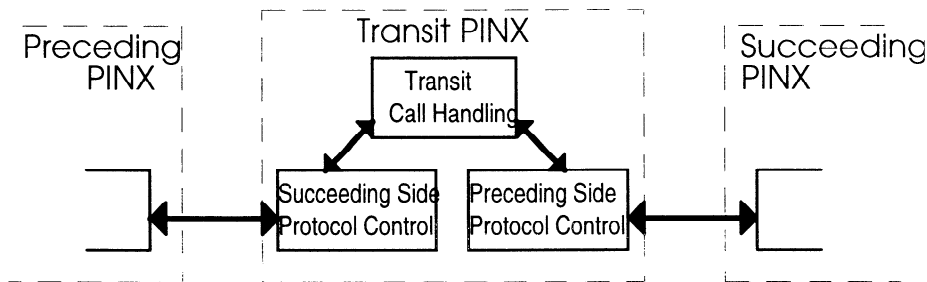


Figure 6 — Conceptual Relationship between Call/Connection Handling and Protocol Control

The Transit PINX's Call/Connection Handling states used in this clause are a different set of states from the Protocol Control states described in earlier clauses. The Transit PINX's Call/Connection Handling states are marked as such by "TCC_" in front of their names. These states are conceptual and used only as an aid to description of the actions required at a Transit PINX. As such, they are not directly visible in the protocol and cannot be tested directly. A short description of each of the states is given below.

Any reference to messages received shall be interpreted as meaning a message which has passed the validation checks of Protocol Control and which has therefore resulted in a notification being given to Call/Connection Handling.

On receipt of a SETUP message, if the Call/Connection Handling of the PINX chooses to route the call/connection onwards on a further inter-PINX link employing the signalling protocol specified in this International Standard, it shall conform to the procedures for a Transit PINX contained in this clause. The procedures defined in this clause show how the message flows of the two interfaces on either side of a Transit PINX are interrelated.

Detailed specification and description language (SDL) diagrams for the procedures specified in this clause are contained in annex G.

12.1.1 Receipt of SETUP message

On receipt of a SETUP message from the Preceding PINX, the call/connection request shall be processed.

NOTE 22. Processing includes among other actions acceptance of the incoming and selection of an outgoing user plane virtual channel.

If the processing is successful and a regular broadband service is requested, a CALL PROCEEDING message shall be sent to the Preceding PINX, a SETUP message shall be sent to the Succeeding PINX, and the Transit PINX shall enter the TCC_Incoming_Call_Proceeding state.

If the processing is not successful, a RELEASE COMPLETE message shall be sent to the Preceding PINX, and the Transit PINX shall remain in the TCC_Idle state.

For determination of service category, selection of traffic parameters, negotiation of traffic parameters and selection of quality of service parameters the procedures of PNNI 1.0, clause 6.5.2.3 shall apply, with the following exception: Crankback procedures shall not apply.

If the SETUP message contains an OAM traffic descriptor information element with field Shaping indicator set to "aggregate shaping of user and OAM cells is not allowed, if shaping is applied by the network" then the PINX shall not apply aggregate shaping. If the PINX cannot comply with this requirement the call/connection request shall be considered unsuccessful. The cause value used in this case should be #63, *service or option not available, unspecified*.

12.1.2 Channel through connection procedures

During call/connection setup, the Transit PINX should through connect the agreed user plane virtual channel to the Succeeding PINX as outlined below.

The earliest point at which through connection may occur (in either forward, backward or both directions) is when the Transit PINX receives the first response to an outgoing SETUP message.

The latest point that through connection in both directions shall occur is on receipt of a CONNECT message from the Succeeding PINX.

NOTE 23. It is recommended that through connection in both directions be achieved as early as possible during call/connection set up. This is important for services providing the conveyance of speech information. Delaying through connection, particularly in the backward direction, to a later stage during call/connection setup may lead to "speech clipping".

12.1.3 State TCC_Incoming_Call_Proceeding

If a RELEASE COMPLETE message is received from the Succeeding PINX, the call/connection shall either be cleared as described in 12.1.7.1, or other procedures may be attempted by the Transit PINX.

If a CALL PROCEEDING message is received from the Succeeding PINX, the Transit PINX may through connect the user plane virtual channel and shall enter the TCC_Transit_Call_Proceeding state.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call/connection shall be cleared as described in 12.1.7.1.

If, for any reason, the Transit PINX decides to abort the call/connection, it shall clear the call/connection in both directions as described in 12.1.7.2.

12.1.4 State TCC_Transit_Call_Proceeding

If an ALERTING message is received from the Succeeding PINX, an ALERTING message shall be sent to the Preceding PINX, and the Transit PINX shall enter the TCC_Call_Alerting state. The user plane virtual channel may be through connected in the backward direction or in both directions.

If a CONNECT message is received from the Succeeding PINX, a CONNECT message shall be sent to the Preceding PINX and the Transit PINX shall through connect the user plane virtual channel in both directions (unless it has already done so) and enter the TCC_Call_Active state. The ATM traffic descriptor information element shall be handled according to PNNI 1.0, clause 6.5.2.6.1 and 6.5.2.6.2.

If a PROGRESS message is received from the Succeeding PINX, a PROGRESS message shall be sent to the Preceding PINX, and no state change shall occur.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call/connection shall be cleared as described in 12.1.7.1.

If a RELEASE or RELEASE COMPLETE message is received from the Succeeding PINX, the call/connection shall either be cleared using procedures as described in 12.1.7.1, or other procedures may be attempted by the Transit PINX.

If, for any reason, the Transit PINX decides to abort the call/connection, it shall clear the call/connection in both directions as described in 12.1.7.2.

12.1.5 State TCC_Call_Alerting

If a CONNECT message is received from the Succeeding PINX, a CONNECT message shall be sent to the Preceding PINX and the Transit PINX shall through connect the user plane virtual channel in both directions (unless it has already done so) and enter the TCC_Call_Active state. The ATM traffic descriptor information element shall be handled according to PNNI 1.0, clause 6.5.2.6.1 and 6.5.2.6.2.

If a PROGRESS message is received from the Succeeding PINX, a PROGRESS message shall be sent to the Preceding PINX, and no state change shall occur.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call/connection shall be cleared as described in 12.1.7.1.

If a RELEASE or RELEASE COMPLETE message is received from the Succeeding PINX, the call/connection shall be cleared as described in 12.1.7.1.

If, for any reason, the Transit PINX decides to abort the call/connection, it shall clear the call/connection in both directions as described in 12.1.7.2.

12.1.6 State TCC_Call_Active

If a RELEASE or RELEASE COMPLETE message is received from either the Preceding or Succeeding PINXs, the call/connection shall be cleared as described in 12.1.7.1.

If, for any reason, the Transit PINX decides to abort the call/connection, it shall clear the call/connection in both directions as described in 12.1.7.2.

12.1.7 Clearing at a Transit PINX

12.1.7.1 Call/connection clearing not initiated by the Transit PINX

On receipt of a RELEASE or RELEASE COMPLETE message from the Preceding PINX, the Transit PINX shall:

- disconnect the incoming and outgoing virtual channels, if connected,
- send a RELEASE message to the Succeeding PINX,
- if a RELEASE message was received from the Preceding PINX, send a RELEASE COMPLETE message to the Preceding PINX, and
- enter the TCC_Await_Outgoing_Release state.

When subsequently a RELEASE COMPLETE message is received from the Succeeding PINX, the Transit PINX shall release any assigned resources and revert to the TCC_Idle state.

On receipt of a RELEASE or RELEASE COMPLETE message from the Succeeding PINX, the Transit PINX shall disconnect the incoming and outgoing user plane virtual channels, if connected, and send a RELEASE message to the Preceding PINX. Alternatively, during call/connection establishment, if the call/connection has not yet reached the TCC_Call_Alerting state, the Transit PINX may attempt some other (unspecified) procedure instead of sending RELEASE to the Preceding PINX.

If a RELEASE message was received from the Succeeding PINX, the Transit PINX shall send a RELEASE COMPLETE message to the Succeeding PINX.

If a RELEASE message was sent to the Preceding PINX, the Transit PINX shall enter the TCC_Await_Incoming_Release state. When subsequently a RELEASE COMPLETE message is received from the

Preceding PINX, the Transit PINX shall release any assigned resources and revert to the TCC_Idle state.

12.1.7.2 Call/connection clearing initiated by the Transit PINX

If a Transit PINX decides to abort a call/connection, it shall disconnect the incoming and outgoing user plane virtual channels, if connected, send (in both directions) a RELEASE message and enter the TCC_Await_Two-Way_Release state. Each side of the PINX shall then continue normal clearing procedures (i.e. release of all associated resources) independently of the other.

If subsequently a RELEASE COMPLETE message is received first from the Preceding PINX or the Succeeding PINX the Transit PINX shall enter the TCC_Await_Outgoing_Release or the TCC_Await_Incoming_Release state, respectively. On receipt of a RELEASE COMPLETE message from the second side the Transit PINX shall revert to the TCC_Idle state.

12.1.8 Additional procedures for N-PISN interworking

The following procedures are in addition to the Transit PINX call/connection handling requirements described in 12.1.1 through 12.1.7 and the protocol control requirements described in clause 11.

If an N-PISN service is requested the SETUP message may contain incomplete called party number information. If the Transit PINX either recognizes that the address information is incomplete or is not able to determine whether it is complete, the Transit PINX shall:

- send a SETUP ACKNOWLEDGE message to the Preceding PINX;
- if enough digits have been received to route the call/connection, send a SETUP message to the Succeeding PINX and enter the TCC_Await_Additional_Digits state,
- else enter the TCC_Await_Digits state.

12.1.8.1 State TCC_Await_Digits

Additional address information is received in INFORMATION messages. Once enough address information has been received in order to route the call/connection, a SETUP message shall be sent to the Succeeding PINX. If, on analysis of the digits, the Transit PINX identifies that there are no more digits expected, a CALL PROCEEDING message shall be sent to the Preceding PINX and the Transit PINX shall enter the TCC_Incoming_Call_Proceeding state; otherwise the Transit PINX shall enter the TCC_Await_Additional_Digits state.

NOTE 24. The method by which the Transit PINX determines that the address information is adequate for the particular use is beyond the scope of this International Standard.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call/connection shall be cleared as described in 12.1.7.1.

If, for any reason, the Transit PINX decides to abort the call/connection, it shall clear the call/connection by sending a RELEASE message to the Preceding PINX and continuing normal clearing procedures as described in 12.1.7.2.

If the Protocol Control of the Succeeding Side of the interface notifies the Transit Call/Connection Handling that T302 has expired, then the PINX may either clear the call/connection by sending RELEASE to the Preceding PINX, or attempt some other (unspecified) procedure.

12.1.8.2 State TCC_Await_Additional_Digits

Any additional address information which is received in INFORMATION messages shall be buffered in the Transit PINX whilst waiting for a response to the SETUP message that has been sent to the Succeeding PINX. If the Transit PINX determines that the address information it has received is complete, a CALL PROCEEDING message shall be sent to the Preceding PINX and the Transit PINX shall enter the TCC_Incoming_Call_Proceeding state; otherwise it shall remain in the TCC_Await_Additional_Digits state.

If a SETUP ACKNOWLEDGE message is received from the Succeeding PINX, the Transit PINX shall enter the TCC_Overlap state and may through connect the user plane virtual channel. Any buffered address information shall be forwarded to the Succeeding PINX in an INFORMATION message.

If a RELEASE COMPLETE message is received from the Succeeding PINX, the call/connection may either be cleared as described in 12.1.7.1, or the PINX may attempt some other (unspecified) procedure.

If a CALL PROCEEDING message is received from the Succeeding PINX, no more address information shall be sent to the Succeeding PINX, and the Transit PINX shall enter the TCC_Transit_Call_Proceeding state and may through connect the user plane virtual channel. Any buffered address information shall be discarded and any further INFORMATION messages received shall be ignored.

If a RELEASE or RELEASE COMPLETE message is received from the Preceding PINX, the call/connection shall be