The ATM Forum
Technical Committee

ATM Inter-Network Interface (AINI) Specification

AF-CS-0125.000

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1 General

1.1 Scope

This document defines the ATM Inter-Network Interface (AINI) protocol for use between ATM networks. The scope of the specification is limited to signalling that is the procedures for dynamically establishing, maintaining, and clearing ATM connections between ATM networks. The procedures are defined in terms of messages and information elements used to characterize the ATM connection.
The protocol is based on ATM Forum PNNI signalling.

The networks on either side of the AINI may be running any protocol internally. However, the goal in defining this protocol is to facilitate interworking of one network running PNNI internally with another network running B-ISUP internally. The protocol also supports interworking of two networks running PNNI internally. In addition to defining the AINI signalling protocol, this specification also defines protocol interworking between AINI and PNNI, and between AINI and B-ISUP. Protocol interworking between AINI and any other protocol is not considered in this specification.

The networks involved can either be ATM service provider (ASP) networks or private networks.

1.2 Capabilities at the AINI

The following table lists the capabilities supported by signalling at the AINI.

Table 1-1: Mandatory and Optional Capabilities

No.	Capabilities	
1	Point-to-point calls	M
2	Point-to-multipoint calls	O
3	Signalling of Individual QoS parameters	O (Note)
4	Crankback	O (Note)
5	Alternate routing as a result of Crankback	O
6	Associated signalling	O
7	Negotiation of ATM traffic descriptors	O
8	Switched Virtual Path (VP) service	O
9	Soft PVPC and PVCC support	O
10	ABR Signalling for point-to-point calls	O
11	Generic identifier transport (GIT)	O
12	Transport of Frame discard indication	O (Note)
13	AINI/PNNI interworking	O
14	AINI/B-ISUP interworking	O
15	Security Signalling	O
16	Transported Address Stack	O
17	Generic Application Transport	O

M: Mandatory
O: Optional

Note: Support is mandatory when AINI/ PNNI interworking is supported and optional otherwise.

2 Addressing

Either one of the following two ATM address formats may be used across an ATM Inter-Network Interface:

1. Native E.164 numbers, as described in Section 3.2 of the ATM Forum Addressing: Reference Guide [ATM Forum, af-ra-0106.000].
     or
2. ATM End System Addresses (AESAs), as defined in Section 3.1 of the ATM Forum Addressing: Reference Guide [ATM Forum, af-ra-0106.000].

Although the protocol provides the means for ATM service providers to construct networks supporting all address formats, this does NOT imply that an ATM service provider is required to support all of them or that a customer is required to use all of them. In no case should any ATM Forum specification be interpreted as requiring an ATM service provider to use or to support or to accommodate any particular address type or address plan.

Further information and guidelines regarding the use of ATM addresses can be found in the ATM Forum Addressing: Reference Guide [ATM Forum, af-ra-0106.000] and in the ATM Forum Addressing: User Guide [ATM Forum, af-ra-0105.000].

3   AINI Signalling Specification

Sections 3.1 through 3.6 of the ATM Inter-Network Interface specification are to be understood as a Delta document to section 6 of af-pnni-0055.000, "Private Network-Network Interface specification version 1.0 (PNNI 1.0), as modified by the following ATM-Forum documents:

- af-pnni-0075.000 [PNNI ABR Addendum],

- af-cs-0116.000 [PNNI Version 1.0 Security Signaling Addendum],

- af-cs-0115.000, [PNNI Transported Address Stack v1.0],

- af-cs-0126.000, [PNNI Addendum for Generic Application Transport Version 1.0],

- af-cs-0127.000, [PNNI SPVC Addendum version 1.0],   and

- af-pnni-0081.000 [PNNI V1.0 Errata and PICS], section 3, items number 75 through 81.

All subsections of Section 6 of PNNI V1.0 shall apply unless exceptions and modifications are explicitly described in this section of the AINI specification. No other sections of PNNI 1.0 apply. Applicability of the Annexes and Appendices of PNNI V1.0 is described in sections 3.7 and 3.8, respectively.

The modified text constitutes the Signalling part of the AINI specification.

Adaptation of Terminology:
For the purpose of adapting the PNNI terminology to the AINI, the following changes are made throughout section 3.

- "PNNI" is replaced by "AINI"

- "Network node" is replaced by "Network"

Changes to individual subsections:

- For clarity of exposition, all second level subsections of Section 6/PNNI V1.0 are mirrored in a corresponding subsection of Section 3/AINI in the following.
- Lower level subsections are listed only when modified beyond the global changes mentioned above.
- Subsections of referenced documents, such as PNNI V1.0, are identified by the actual subsection number from that document, the document name, and the title of the subsections.
  For example, a modification to section 6.3.1.6 of PNNI V1.0 is identified by a statement labeled as "6.3.1.6 / PNNI 1.0 SETUP".

PNNI V1.0 features not supported at the AINI:

- PNNI V1.0 Designated Transit List (DTL)
- ATM Anycast

Start of Delta Description to PNNI 1.0

6/PNNI 1.0 **PNNI Signalling Specification**

Replace all text with the following:

This section contains the procedures to dynamically establish, maintain, and clear ATM connections across the ATM Inter-Network Interface (AINI) between two ATM networks. The procedures are defined in terms of messages and information elements used to characterize the ATM connection. The protocol is based on ATM Forum PNNI signalling, which is itself based on ATM Forum UNI signalling.

3.1 AINI Model

6.1/PNNI 1.0 **PNNI Model**

3.2 Overview of Call/connection control

6.2/PNNI 1.0 **Overview of Call/connection control**

3.3 Message functional definition and contents

6.3/PNNI 1.0 **Message functional definition and contents**

6.3.1/PNNI 1.0 Messages for ATM point-to-point call and connection control

Add the following note after Table 6-1

Note: See 6.3.2 /PNNI 1.0 for additional and modified messages and 6.4.7/PNNI 1.0 for additional information elements for the support of 64 kbit/s based ISDN circuit mode services (interworking with N-ISDN)

6.3.1.4/PNNI 1.0 RELEASE

The length of the Crankback information element is modified to 4-7.

6.3.1.5/PNNI 1.0 RELEASE COMPLETE

The length of the Crankback information element is modified to 4-7.

6.3.1.6/PNNI 1.0 SETUP

Reference to Note 6 regarding the Broadband repeat indicator information element is replaced by Note 1.
Note 6 is not applicable.
The Connection scope selection information element is not supported.
The Designated transit list information element is not supported.
Note 7 does not apply.

6.3.2.4/PNNI 1.0 RELEASE

Replace the first paragraph with the following text:

> This message is sent by a network to an adjacent network to indicate that it has cleared the connection and is waiting to release the call reference.

6.3.4.1/PNNI 1.0 ADD PARTY

Reference to Note 5 regarding the Broadband repeat indicator information element is replaced by Note 1.
Note 5 is not applicable.
The Designated transit list information element is not supported.
Note 6 does not apply.

6.3.4.4/PNNI 1.0 ADD PARTY REJECT

The length of the Crankback information element is modified to 4-7.

3.4   General message format and information element coding

6.4/PNNI 1.0   General message format and information element coding

6.4.2/PNNI 1.0 Protocol discriminator

Add the following text to the end of the section:

> Note: AINI signalling uses the same protocol discriminator as for PNNI signalling and BQSIG.

6.4.5.1/PNNI 1.0 Coding rules

Table 6-5:
   The maximum length of the Crankback information element is modified to 7.
   The Designated transit list information element is not supported.
   The Connection scope selection information element is not supported.

6.4.5.19/PNNI 1.0 Cause

The codepoint for cause #53 "Call cleared due to change in PGL" is not supported.

6.4.5.23/PNNI 1.0 Connection scope selection

This information element is not supported.

6.4.6.1/PNNI 1.0 Calling party soft PVPC or PVCC

For the coding of this information element refer to "PNNI SPVC Addendum version 1.0".

6.4.6.2/PNNI 1.0 Called party soft PVPC or PVCC

For the coding of this information element refer to "PNNI SPVC Addendum version 1.0".

6.4.6.3/PNNI 1.0 Crankback

Replace the first paragraph with the following text:

The purpose of the Crankback information element is to indicate that crankback procedures have been initiated.

Modify as follows

    Crankback level (octet 5)

    The Crankback level is always set to 255.

  Blocked transit type (octet 6)

    The values of Blocked transit type are replaced with the following:

Bits 8 7 6 5 4 3 2 1	Meaning	Length of blocked transit identifier
0 0 0 0 0 0 1 0	call or party has been blocked at the succeeding end of this interface	0
1 1 1 1 1 1 1 1	call or party has been blocked at or beyond the succeeding node	0

    All other codepoints are not supported.

  Blocked transit identifier (octet 6.1)

The blocked transit identifier is not present.

  Crankback cause (octet 7)

    The following Crankback cause codepoints are not supported:
      #128 "next node unreachable",
      #160 "DTL Transit not my node ID".

Notes 1 and 2 are not supported.

  Crankback cause diagnostics (Octet 7.1)

The Crankback cause diagnostics field is not present.

6.4.6.4/PNNI 1.0 Designated transit list

This Information Element is not supported.

3.5   Call/connection control procedures for ATM point-to-point calls

6.5/PNNI 1.0 Call/connection control procedures for ATM point-to-point calls

Replace the first sentence of the second paragraph with the following text:

> Procedures based on ATM Forum PNNI 1.0 signalling are used to establish ATM switched virtual connections. The PNNI 1.0 signalling procedures for point-to-point calls are based on the procedures described in ATM Forum UNI Signalling and ITU-T Recommendation Q.2931.

6.5.1/PNNI 1.0 Establishment of a signalling AAL

Remove the word "private" in the first sentence.

6.5.2.1/PNNI 1.0 Call/connection request

Replace the last sentence of the second paragraph with the following text:

> The ATM traffic descriptor and Broadband bearer capability information elements are mandatory in the SETUP message. According to Table 3-8/Q.2931, the Quality of Service parameter information element is mandatory in the SETUP message. From UNI 4.0 Signalling, Section 9.2, it follows that at least one of the Quality of service parameter or Extended QoS parameters information elements must be present. If the Quality of service parameter information element is not present, this means that no interworking with ITU-T protocols is desired.

The third paragraph on ATM anycast does not apply.

6.5.2.2/PNNI 1.0 Connection identifier allocation/selection

At the end of item ii), add the following sentence:

> The signalling channel does not control virtual channels or virtual paths on another physical link.

Replace the last sentence of the first paragraph with the following text:

> The associated signalling procedures are used only when two networks are connected by a virtual path connection used as a logical link.

6.5.2.2.1/PNNI 1.0 Associated Signalling

Replace the last paragraph with the following text:

> Call collision can occur when both sides of an interface simultaneously transfer SETUP messages indicating the same exclusive VPCI and VCI. In order to avoid call collision, for each AINI interface it must be

defined via administration (based on mutual agreement between operators), which side is the assigning network, i.e. which network shall allocate the connection identifier (VPCI, VCI) values. A preceding side that is the assigning network shall include a Connection identifier information element in the SETUP message with option (b) (exclusive VPCI and exclusive VCI). A SETUP message from a preceding side, which is the non-assigning network, shall use option (a).

6.5.2.2.2.1/PNNI 1.0 Allocation for switched virtual channels

Replace the last paragraph with the following text:

Call collision can occur when both sides of an interface simultaneously transfer SETUP messages indicating the same exclusive VPCI and VCI. In order to avoid call collision, for each AINI interface it must be defined via administration (based on mutual agreement between operators), which side is the assigning network, i.e. which network shall allocate the connection identifier (VPCI, VCI) values. A preceding side that is the assigning network shall include a Connection identifier information element in the SETUP message with option (b) (exclusive VPCI and exclusive VCI). A SETUP message from a preceding side, which is the non-assigning network, shall use options (a) or (c).

6.5.2.2.2.2/PNNI 1.0 Allocation for switched virtual paths

Replace the last paragraph with the following text:

Call collision can occur when both sides of an interface simultaneously transfer SETUP messages indicating the same exclusive VPCI. In order to avoid call collision, for each AINI interface it must be defined via administration (based on mutual agreement between operators), which side is the assigning network, i.e. which network shall allocate the connection identifier (VPCI) values. A preceding side that is the assigning network shall include a Connection identifier information element in the SETUP message with option (d) (exclusive VPCI and no VCI). A SETUP message from a preceding side, which is the non-assigning network, shall use option (c).

6.5.2.3.3/PNNI 1.0   Traffic parameter selection procedures

Replace "node" with "network".

6.5.2.3.5/PNNI 1.0   QoS parameter selection procedures

Replace all text with the following:

Start of replacement text for 6.5.2.3.5/PNNI 1.0

QoS requirements are signalled across AINI interfaces using one of the following methods:

1. Through the values of individual quality of service parameters, which are included in the Extended QoS parameters information element, and optionally the End-to-end transit delay information element;

2. In terms of QoS classes, which are signalled in the QoS parameter information element, and optionally through the value of the QoS related field cell transfer delay, which is signalled in the End-to-end transit delay information element;

3. Both of the above.

Note: Both the Extended QoS parameters information element and the QoS parameter information element can be present in the SETUP message, at least one of these has to be present (See section 9 of UNI Signalling 4.0 for additional information).

The allowed set of individual QoS parameters and/or QoS classes in the SETUP message is determined by the ATM service category of the call.

6.5.2.3.5.1   Procedures at the preceding side

6.5.2.3.5.1.1   Handling of the QoS parameter information element

When the signalling protocol entity at the preceding side receives a setup indication that includes a QoS parameter information element, it shall include a QoS parameter information element in the corresponding SETUP message.

When the signalling protocol entity at the preceding side belongs to an B-ISUP network and receives a setup indication that does not include a QoS parameter information element, it shall include a QoS parameter information element in the corresponding SETUP message with QoS class set to "unspecified".

6.5.2.3.5.1.2   Handling of the Extended QoS parameters information element and the End-to-end transit delay information element

When the signalling protocol entity at the preceding side receives a setup indication, in which no Extended QoS parameters information element is contained, then:
When the ATM service category of the call is CBR, real-time VBR, or non-real-time VBR, as an option, it may generate an Extended QoS parameters information element before progressing the call. A local mapping is used based on the service category and the forward and backward QoS class fields in the QoS parameter information element. In addition, an End-to-end transit delay information element may be generated as part of the above mapping, if it was not contained in the received setup indication.
When such a mapping is used:

-    All individual QoS parameters for which values are implied (from the QoS classes included in the QoS parameters information element and the ATM service category of the call) must be specified;

-    For each individual QoS parameter, if an acceptable value of a parameter is included and the end-to-end value of that parameter is determined by accumulation, then the corresponding cumulative value of the parameter shall also be included. All cumulative parameter values generated from the mapping must be initialized to zero before beginning processing of the individual QoS parameters;

-    The origin of each information element including one or more of the newly generated individual QoS parameters must be marked as an "intermediate network" (i.e., in the Extended QoS parameters information element the Origin field is set to "intermediate network", and in the End-to-end transit delay information element a "network-generated indicator" is included).

For each parameter contained in the Extended QoS parameters information element and/or the End-to-end transit delay information element, the preceding side shall take the following actions (whether the information element was contained in the received setup indication or whether the information element was generated by the process described in the preceding paragraph):

1.   Optionally increment the cumulative forward and backward values of the parameter to account for expected increases due to user data transfer within this network over the related connection, if known and not already accounted for.

2.   Increment the cumulative forward value of the parameter to account for expected increases due to user data transfer over this link (from the preceding network to the succeeding network).

3.   Determine if the highest/lowest acceptable values of that parameter can be supported. If no values {less than/greater than} or equal to the highest/lowest acceptable value can be supported, then the preceding side shall reject the call. If, in that case, the previous interface is a PNNI interface, the crankback procedures specified in PNNI 1.0, Annex B, section 8 shall be followed, using cause#49, "Quality of service unavailable", and the corresponding crankback cause.

If no acceptable value of an allowed individual QoS parameter for the corresponding ATM service category is specified (in the Extended QoS parameters or End-to-end transit delay information elements), then the default is that any value of the individual QoS parameter is acceptable and the preceding side shall continue to process the call.

If the preceding side is able to provide the acceptable values of all specified individual QoS parameters, the preceding side shall progress the call to the succeeding side and include all available QoS related information in the Extended QoS parameters information element and/or the End-to-end transit delay information element.

6.5.2.3.5.1.3   Additional requirements at the egress of an ATM Service Provider network

If the AINI is at the egress of an ATM Service Provider network, then:
When the ATM service category of the call is CBR, real-time VBR, or non-real-time VBR, the Extended QoS parameters information element is always provided before progressing the call (i.e. either method 1 or 3 described in section 6.5.2.3.5 shall be used).

6.5.2.3.5.2   Procedures at the succeeding side

6.5.2.3.5.2.1   Handling of the QoS parameter information element

If the QoS parameter information element is not contained in the received SETUP message and the succeeding side belongs to a B-ISUP network it is assumed that no interworking is desired and the call shall be rejected with cause #49, "Quality of service unavailable" (for more information see section 9.2.1 of UNI Signalling 4.0, af-sig-0061.00). In all other cases, the additional procedures in the section below are followed.

6.5.2.3.5.2.2   Handling of the Extended QoS parameters information element and the End-to-end transit delay information element

If no Extended QoS parameters information element is contained in the received SETUP message, the succeeding side may generate the information element following the procedures described in section 6.5.2.3.5.1
For each parameter contained in the Extended QoS parameters information element and/or the End-to-end transit delay information element (whether the information element was contained in the received SETUP message or whether the information element was generated), the succeeding side shall:

1. Increment the backward cumulative value of the parameter, if the parameter is cumulative, to account for the expected increases due to user data transfer over this link (from the succeeding network to the preceding network).

2. Optionally increment the cumulative forward and backward values of the parameter to account for expected increases due to user data transfer within all or part of this network over the related connection, if known and not accounted for when the call is progressed within this network.

3. Determine if the highest/lowest acceptable value of that parameter can be supported. If no values {less than/greater than} or equal to the highest/lowest acceptable value can be supported, then the succeeding side shall follow the crankback procedures specified in Annex A §5.5.1.3. A RELEASE or RELEASE COMPLETE message (depending on whether or not a CALL PROCEEDING message has been sent yet) shall be returned with cause #49, "Quality of service unavailable", and a Crankback information element with the corresponding crankback cause code.

If no acceptable value of an allowed individual QoS parameter for the corresponding ATM service category is specified (in the Extended QoS Parameters or End-to-end transit delay information elements), then the default is that any value of the individual QoS parameter is acceptable and the succeeding side shall continue to process the call.

6.5.2.3.5.2.3   Additional procedures

If the succeeding side is able to provide the requested Quality of Service (based on the information contained in the received SETUP message) the succeeding side shall continue to progress the call.
If the succeeding side is not able to provide the requested Quality of Service (based on the information contained in the received SETUP message) the succeeding side shall reject the call. A RELEASE or RELEASE COMPLETE message (depending on whether or not a CALL PROCEEDING message has been sent yet) shall be returned with cause #49, "Quality of service unavailable" and the corresponding crankback cause code when applicable.

End of replacement text for 6.5.2.3.5/PNNI 1.0

6.5.2.3.6/PNNI 1.0 Traffic parameter selection procedures for ABR connections

Replace the third paragraph with the following text:

> The negotiation procedures allow each network to adjust the parameters of a call as needed to protect the resources in that network and the quality of service commitments made to other connections.

Delete the fourth paragraph.

Add the following note:

> Note: The PNNI ABR Addendum modifies this section.

6.5.2.3.7/PNNI 1.0 Processing of Cumulative RM fixed round-trip time parameter for ABR connections

Replace all text with the following:

> The succeeding side shall adjust the cumulative RM fixed round-trip time parameter in the ABR setup parameters information element. The amount of the adjustment is the sum of the forward and reverse direction fixed portion of the RM cell delay on the AINI, including the forward and reverse link propagation delays and any fixed processing delays at the AINI and within the switching system. The adjustment value, expressed in microseconds encoded as an integer, is added to the cumulative RM fixed round-trip time parameter.
> Note that the Cumulative ABR RM Fixed Round Trip Time parameter is adjusted only in SETUP message processing, not in CONNECT message processing.

6.5.2.4/PNNI 1.0 Call/connection proceeding

Delete the last sentence of the paragraph following the Note.

6.5.2.6.1/PNNI 1.0 Procedures for traffic parameter selection during call/connection acceptance

Replace "succeeding exchange" with "succeeding side".
Replace "node" with "network".

6.5.2.6.2/PNNI 1.0 Procedures for negotiation of traffic parameters during call/connection acceptance

Replace "node" with "network".

Replace the references to Section 6.5.2.6.2/PNNI 1.0 at the end of the second and third paragraphs by references to Section 6.5.2.6.1/PNNI 1.0.

6.5.3/PNNI 1.0 Call/connection clearing

The reference to "Annex B/PNNI 1.0" is replaced by "Annex A/AINI".

6.5.3.2/PNNI 1.0 Exception conditions

Replace the last sentence with the following text:

When the succeeding side has received a SETUP message, no response has previously been sent, and the succeeding side wants to reject the call/connection, it shall:
−   respond with a RELEASE COMPLETE message,
−   release the call reference, and
−   enter the Null state.

6.5.7.1/PNNI 1.0 Unexpected or unrecognized message type

Replace the last paragraph with the following:

If the pass along request (bit 4) in the instruction field is set to "pass along request" in an unrecognized message and the interface has been configured to allow the pass along of unrecognized messages, the message shall be passed on without error checking, provided the next interface is a PNNI or AINI. Note that the default mode of operation is to allow the pass along of unrecognized messages with "pass along request".

The remaining error procedures in this section apply to unrecognized messages only if
−   the pass along request (bit 4) in the instruction field is set to "no pass along request", or
−   the pass along request (bit 4) is set to "pass along request" but the interface has been configured to not pass along unrecognized messages.

6.5.7.2/PNNI 1.0 Information element error

Replace the last paragraph with the following:

If the pass along request (bit 4) in the instruction field is set to "pass along request" in an unrecognized information element and the interface has been configured to allow the pass along of unrecognized information elements, the information element shall be passed on in the message without error checking, provided the next interface is a PNNI or AINI. Note that the default mode of operation is to allow the pass along of unrecognized information elements with "pass along request".

The remaining error procedures in this section apply to unrecognized information elements only if
−   the pass along request (bit 4) in the instruction field is set to "no pass along request", or
−   the pass along request (bit 4) is set to "pass along request" but the interface has been configured to not pass along unrecognized information elements.

6.5.9/PNNI 1.0 Network node call control requirements

This section is not applicable to AINI.

3.6   Call/connection control procedures for point-to-multipoint calls

3.6/PNNI 1.0   Call/connection control procedures for point-to-multipoint calls

6.6.2/PNNI 1.0 Adding a party

The reference to "Annex B/PNNI 1.0" in item 3 is replaced by "Annex A/AINI".

6.6.3/PNNI 1.0 Party dropping

The reference to "Annex B/PNNI 1.0" in item 3 is replaced by "Annex A/AINI".

3.7   Applicability of PNNI 1.0 Annexes to AINI

The following table gives a list of the Annexes to PNNI 1.0 and their applicability to AINI signalling.

Table 3-1: Applicability of PNNI 1.0 Annexes

Annex A/PNNI, DTL:	N/A
Annex B/PNNI 1.0, Crankback procedures:	Superceded by Annex A/AINI
Annex C/PNNI, Soft PVC procedures:	Superceded by the PNNI SPVC Addendum, Version 1.0. Section 5 - "Compatibility with Nodes Not Supporting This Feature" of the Addendum does not apply
Annex D/PNNI 1.0,: Architectural constants:	N/A
Annex E/PNNI 1.0, Architectural variables:	N/A
Annex F/PNNI 1.0, Configuration of PNNI Hierarchy	N/A
Annex G/PNNI 1.0, PNNI Minimum Subsets	Superceded by Section 1.2
Annex H/PNNI	N/A

3.8   Applicability of PNNI 1.0 Appendices to AINI

Appendices A through I of PNNI 1.0 are not applicable to AINI signalling.

End of Delta Description to PNNI 1.0

3.9 Delta Description to Transported Address Stack v1.0 Specification

2.3/TAS 1.0 CL-BI FACILITY Message

This section is not supported.

2.4/TAS 1.0 CO-BI SETUP Message

This section is not supported.

4.1.4/TAS 1.0 Messages for CdPN-Routed Message Rejection

Table 4.1-1: The last two rows of the table are not supported.

4.2/TAS 1.0 Interactions with DTL Roles

This section is not supported.

4.3/TAS 1.0 Additional GSS Procedures

This section is not supported.

6.3.4/TAS 1.0 Role – Transport Origination Point (TAS_MC1)

TASO_8 The questions on the FACILITY and CO-BI SETUP messages are not applicable.

4 Protocol Interworking at the AINI

This section describes the protocol interworking between AINI and the protocols B-ISUP and PNNI.

Three configurations are considered

1. PNNI $\rightarrow$ AINI $\rightarrow$ B-ISUP
2. B-ISUP $\rightarrow$ AINI $\rightarrow$ PNNI
3. PNNI $\rightarrow$ AINI $\rightarrow$ PNNI

Case 3 arises when routing information is not to be conveyed between two connected PNNI base networks. A fourth case (B-ISUP $\rightarrow$ AINI $\rightarrow$ B-ISUP) is not considered, since it is assumed that B-ISUP or the - B-ISUP based - B-ICI would be used as the interconnecting protocol in this case. However, the descriptions given below would not exclude this case.

The descriptions given are based on the approach of ITU-T Recommendation Q.2650, *Interworking between Signalling System No. 7/ Broadband ISDN User Part (B-ISUP), and Digital Subscriber Signalling System No. 2 (DSS2)*.
It uses two main techniques to do this:
* Mapping Tables: A descriptive mapping of messages and information elements/parameters used by the protocols interworking.
* Message Sequence Charts: These are referred to as "Arrow Diagrams" in Q.2650. A set of message sequences for basic call procedures using these mappings.

To describe feature (service) interworking between the different protocols these will be complemented by procedural descriptions where necessary (usually in a note to the mapping tables).

The overall network scenarios are shown in the following pictures.

It is acknowledged that the function of the *local exchange* and *exchange* switches may be embodied in a single implementation (e.g., interworking between a UNI and an AINI is defined as the transitive interworking of UNI ↔ PNNI ↔ AINI, but this transitive interworking may be implemented directly).
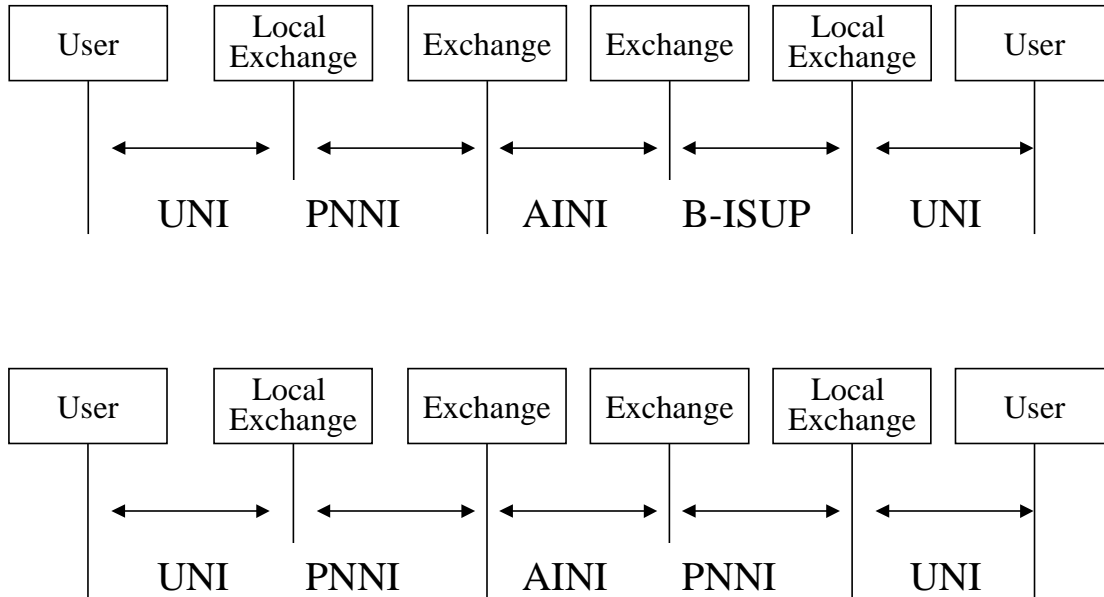
Figure 4-1: Interworking Scenarios

The focus of this specification is shown in the following picture:
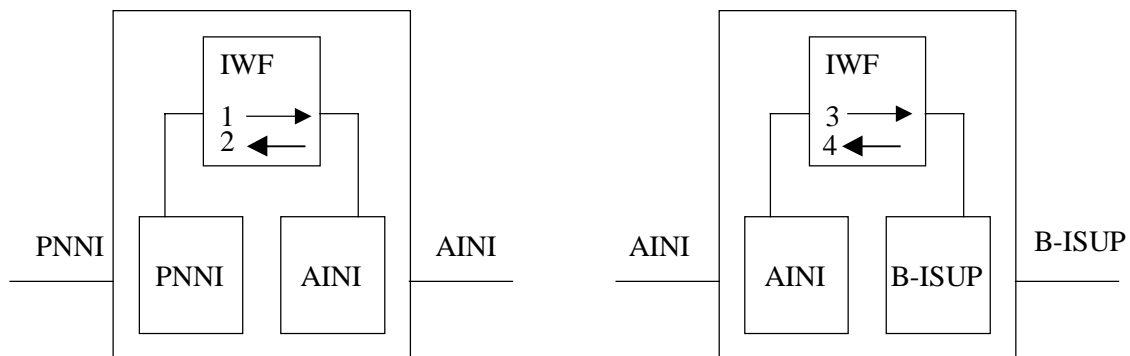
Figure 4-2: Interworking Functions

The subsequent subsections describe the two Interworking Functions (IWF) shown above.
For each of them two directions of flow (input → output) are described: according to which interface initiates the interaction:
1. describing the direction from PNNI to AINI;
2. describing the direction from AINI to PNNI;
3. describing the direction from AINI to B-ISUP;
4. describing the direction from B-ISUP to AINI.

Interworking is shown as arrow diagrams showing the message interworking, with tables being used to show the mapping of parameters. These tables also specify the mapping of information elements and parameters, which are carried by the concerned messages. The information elements and parameters that are of local significance only, i.e., are not mapped onto information elements and parameters in the other signalling system, are not shown.

Handling of parameters and information elements which pertain to features not supported at the AINI:

- If optional they are generally discarded and the call is progressed (usually indicated by "not carried" in the mapping tables).
- In all exceptional cases, specific action is indicated in a Note.

4.1   Interworking between AINI and B-ISUP

This section specifies the protocol interworking between the Broadband ISDN User Part as specified in the ITU Q.27xx series and the ATM Inter-Network Interface. If not specified otherwise, all B-ISUP messages and parameters used in this specification are defined in the ITU Recommendation Q.2763.

4.1.1   Interworking specification for successful call set-up procedures (point-to-point calls)

4.1.1.1   Arrow diagrams

This section contains the interworking arrow diagrams for the successful call set-up procedures for point-to-point calls.
For those messages that are not mapped, for clarification, an "X" precedes the arrowhead.

Mapping of the Address Complete Message (ACM)

If the Called party's status indicators subfield of the Called party's indicator parameter in the ACM message from the B-ISUP does not indicate "alerting", the ACM is not mapped to the AINI. If the Called party's indicators in a subsequent CPG does indicate "alerting" the CPG message is mapped to ALERTING on the AINI. The arrow diagram for this scenario is shown in Figure 4-3.
If the Called Party's Indicators subfield in the B-ISUP ACM does indicate "alerting", the ACM is mapped to the ALERTING. The arrow diagram for this scenario is shown in Figure 4-4.
Figure 4-5 shows the arrow diagram for successful call set-up from B-ISUP to AINI. The sending of ACM is delayed until receipt of ALERTING from the AINI.

Support of Overlap Sending

If the B-ISUP supports overlap sending, the IAM need not contain all the necessary address information. Multiple SAM messages will convey the missing information. Upon reception of ST (end of pulsing), the SETUP message is sent across the AINI. Figure 4-6 shows the arrow diagram for this scenario.
Figure 4-7 and Figure 4-9 show the arrow diagrams for the case that interworking with 64 kbit/s ISDN has taken place.
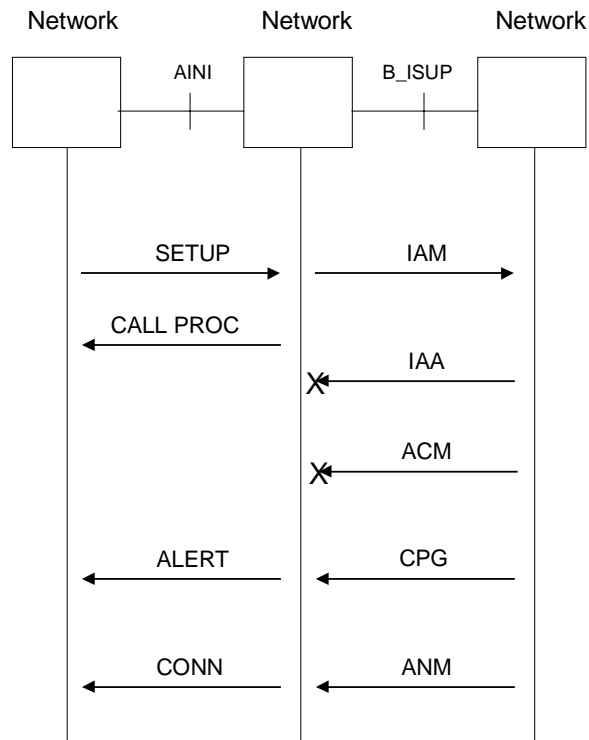
Figure 4-3: Successful call set-up (AINI → B-ISUP)
ACM does not indicate "alerting"
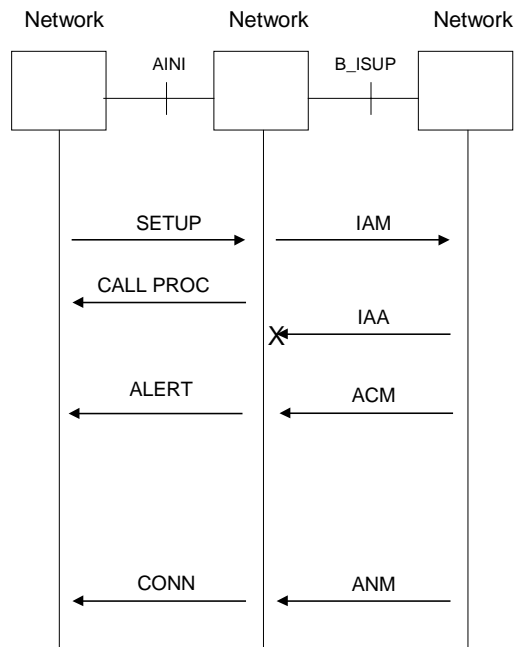
Figure 4-4: Successful call set-up (AINI → B-ISUP)
ACM does indicate "alerting"
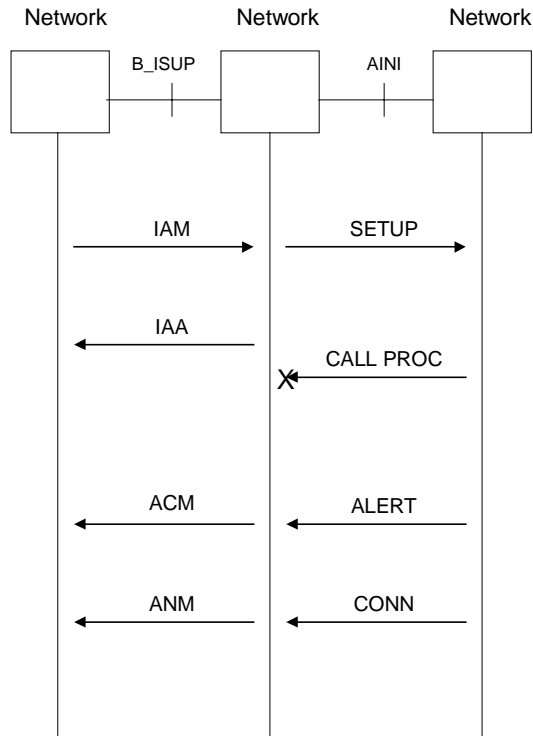
Figure 4-5: Successful call set-up (B-ISUP → AINI)
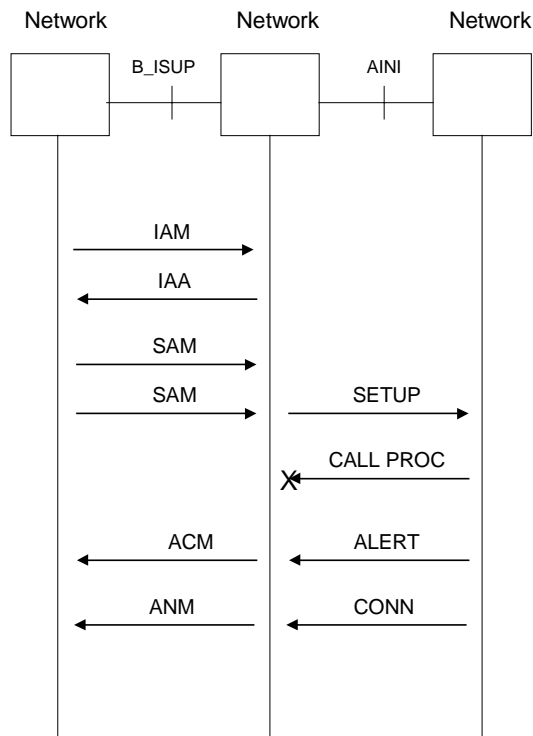
Figure 4-6: Successful call set-up (B-ISUP → AINI)
B-ISUP supports overlap sending
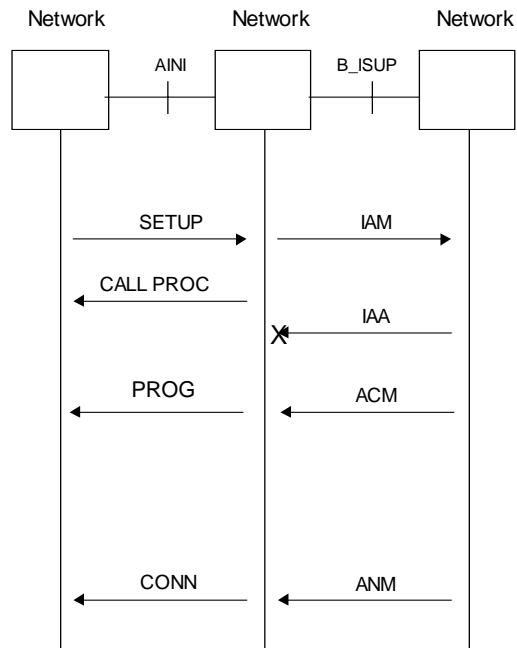
Figure 4-7: Successful call set-up (AINI → B-ISUP)
ACM does indicate interworking
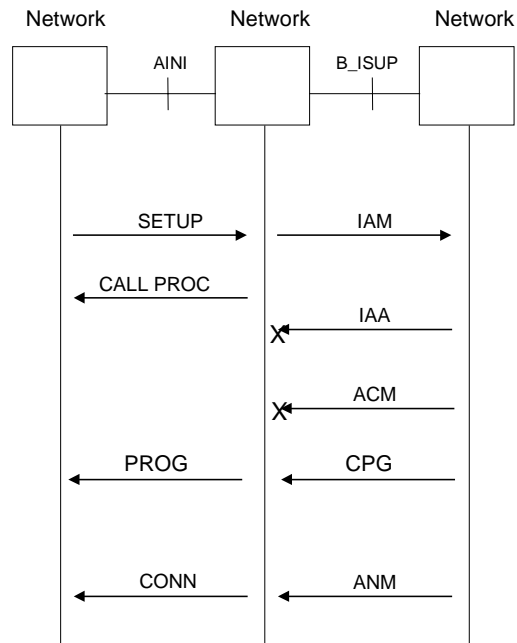
Figure 4-8: Successful call-setup (AINI → B-ISUP)
ACM and CPG do not indicate "alerting"
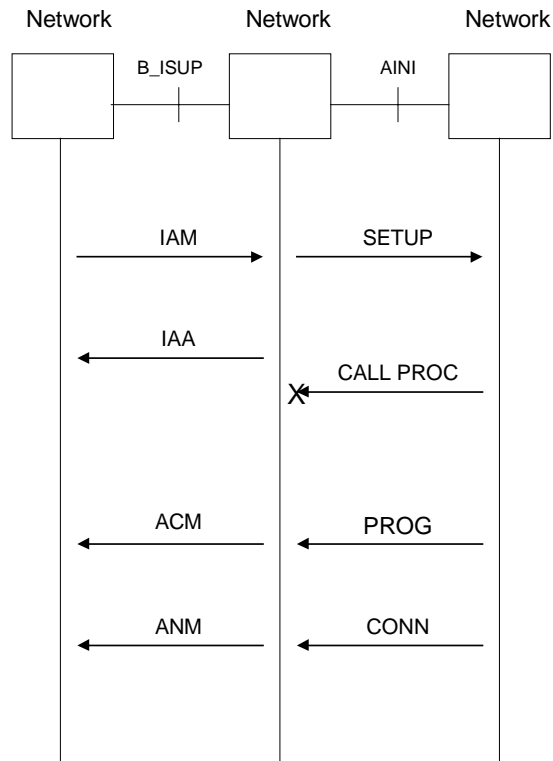
Figure 4-9: Successful call set-up (B-ISUP → AINI)

4.1.1.2   Mapping tables

This section contains the mapping tables of successful call set-up messages, associated parameters, and information elements.

4.1.1.2.1   Mapping of the SETUP Message with the Initial Address Message (IAM)

4.1.1.2.1.1   AINI to B-ISUP

AINI to B-ISUP	
SETUP	**IAM**
	Calling party's category (Note 16)
	Connected line identity request (Note 17)
AAL parameters	AAL parameters
ABR additional parameters	Not carried
ABR setup parameters	ABR setup parameters (according to Q.2723.3)
Alternative ATM traffic descriptor	Alternative ATM cell rate (according to Q.2725.1)
ATM traffic descriptor (Note 1)	ATM cell rate
	Additional ATM cell rate (according to Q.2723.1 and Q.2723.3)
Broadband bearer capability	Broadband bearer capability
Broadband high layer information	Broadband high layer information
Broadband low layer information (Note 3)	Broadband low layer information

AINI to B-ISUP	
SETUP	**IAM**
Called party number (Note 4)	Called party number (Note 5)
	AESA for called party number (according to Q.2726.1)
Called party subaddress (Note 18)	Called party subaddress
Called party soft PVPC or PVCC (Note 20)	PVC called endpoint (according to Q2767.1)
Calling party number (Note 6)	Calling party number (Note 5)
	AESA for calling party number (according to Q.2726.1)
	Additional calling party number (Note 5, 6)
Calling party subaddress (Note 19)	Calling party subaddress
Calling party soft PVPC or PVCC (Note 21)	PVC calling endpoint (according to Q2767.1)
End-to-end transit delay (Note 7)	Propagation delay counter
	Maximum end-to-end transit delay
Extended QoS parameters	Not carried
Generic identifier transport (Note 8)	Application generated identifier(according to Q.2726.4)
Minimum acceptable ATM traffic descriptor	Minimum ATM cell rate (according to Q.2725.1)
Notification indicator (Note 9)	Notification (Note 10)
Narrowband bearer capability (Note 11)	Narrowband bearer capability
Narrowband high layer compatibility (Note 12)	Narrowband high layer compatibility
Narrowband low layer compatibility (Note 13)	Narrowband low layer compatibility
Progress indicator (Note 14)	Progress indicator
QoS parameter (Note 15)	QoS parameter (according to Q.2723.1)
Transit network selection	Transit network selection
Transported address stack	Not carried (Note 2)
Security services	Not carried
Generic application transport	Not carried (Note 22)

NOTES

1. The peak cell rate subfields of the ATM traffic descriptor information element are mapped to the ATM cell rate parameter. Other subfields of the ATM traffic descriptor information element will be carried in the Additional ATM cell rate parameter.
   If Frame Discard or Tagging is requested, the call is forwarded to B-ISUP without this information. If Best Effort is requested and not supported at the B-ISUP side of the interface, the call shall be rejected with cause #65, "bearer capability not implemented".
2. If one or more Transported address stack information elements are included, the call shall be rejected with cause #127, "interworking, unspecified ".
3. The Broadband low layer information element may be repeated. If it is repeated, all instances are mapped into a single Broadband low layer information parameter in the network. The Repeat indicator information element is mapped to the Repeat indicator subfield of the parameter.
4. Interworking with B-ISUP is only possible if the called party number is presented in E.164 AESA format with the type of number set to "unknown" and the numbering plan identification set to "AESA". The Called party number information element is mapped to the Called party number parameter and the AESA for called party parameter. If the called party number in the Called party number information element has any other format, the call shall be rejected with cause #28, "invalid number format".
   The address signal is coded using the E.164 address digits from the initial domain identifier (IDI) field of the AESA address in the information element. The type of number is set to "international number" and the numbering plan identification is set to "E.164".
5. Contents starting with octet 2 as in the information element starting with octet 5.

6. If the calling party number contains the E.164 AESA, with the type of number set to "unknown" and the numbering plan identification set to "AESA", the information element is mapped to the AESA for calling party parameter and either to the Calling party number parameter, if the screening indicator is "user provided, verified and passed" or "network provided", or to the Additional calling party number parameter.
    If the calling party number contains other AESAs (ICD or DCC AESAs), the information element is mapped to the AESA for calling Party parameter alone.
    Note that if octet 5a is omitted, "user provided, not screened " is assumed (TABLE 4-14/Q.2931, Note 13) and "presentation allowed" is assumed for the presentation indicator.

7. The cumulative end-to-end transit delay subfield of the End-to-end transit delay information element is mapped to the Propagation delay counter parameter.
    The Maximum end-to-end transit delay subfield is mapped to the Maximum end-to-end transit delay parameter only if the network generated indicator is not present in the End-to-end transit delay information element. Further, if the End to end transit delay information element is not present, the Propagation delay counter has to be created since it is mandatory for B-ISUP.

8. The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

9. The Notification indicator information element may be repeated. Each instance of the information element is mapped to a separate Notification parameter.

10. The Notification parameter may be repeated in the B-ISUP message.

11. The Narrowband Bearer Capability information element may be repeated. Treatment as in Note 3 above applies. If no Broadband Repeat Indicator information element is present, the priority subfield in B-ISUP should be set to "prioritized list in ascending order".

12. The Narrowband high layer compatibility information element may be repeated. Treatment as in Note 3 above applies. If no Broadband repeat indicator information element is present, the priority subfield in B-ISUP should be set to "prioritized list in ascending order".

13. The Narrowband low layer compatibility information element may be repeated. Treatment as in Note 3 above applies.

14. The Progress indicator information element may be repeated. If repeated, all instances are mapped into a single Progress indicator parameter with priority subfield set to "no prioritized order".

15. According to ATMF UNI Signalling Specification Version 4.0, the QoS parameter information element is mandatory for interworking with networks, which do not support the Extended QoS parameters information element. These include B-ISUP networks supporting only the QoS parameter according to ITU-T Rec. Q.2723.1. As such, if the QoS parameter information element is not present in this case, the call shall be rejected. When a QoS class other than the ITU-T standard class of 0 is supported, it is mapped into the IAM QoS parameter; the instruction indicators for this parameter should indicate "pass on".

16. This parameter must be included in the IAM since it is a mandatory parameter. The calling party's category is set to "ordinary calling subscriber".

17. This parameter is included in the IAM with the "connected line identity request indicator" set to "requested", indicating that the connected number should be included in the Answer message.

18. The Called party subaddress information element may be repeated. If repeated, the call shall be rejected with cause #127, "interworking, unspecified".

19. The Calling party subaddress information element may be repeated. If repeated, the first instance of the information element shall be mapped to the Calling party subaddress parameter if the first instance is an AESA. Otherwise, the second instance shall be mapped. The instance of the information element that is not mapped shall be dropped.

20. If the Called party soft PVPC or PVCC information element contains the DLCI identifier field, the call shall be rejected with cause #127 "interworking, unspecified".

21. If the Calling party soft PVPC or PVCC information element contains the DLCI identifier field, the information element shall be dropped.

22. When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.1.2.1.2   B-ISUP to AINI

B-ISUP	to	AINI
IAM		**SETUP**
AAL parameters		AAL parameters
ABR setup parameters (according to Q.2723.3)		ABR setup parameters
AESA for called party (according to Q.2726.1) Called party number		Called party number (Note 1)
AESA for calling party (according to Q.2726.1) Calling party number Additional calling party number		Calling party number (Note 2)
Alternative ATM cell rate (according to Q.2725.1)		Alternative ATM traffic descriptor
ATM cell rate (Note 8) Additional ATM cell rate		ATM traffic descriptor
Broadband bearer capability		Broadband bearer capability
Broadband high layer information		Broadband high layer information
Broadband low layer information		Broadband low layer information
Called party subaddress		Called party subaddress
Calling party's category		Not carried
Calling party subaddress		Calling party subaddress
Closed user group information (Note 3)		Not carried
Connected line identity request indicator		Not carried
Priority (according to Q.2726.2)		Not carried
PVC called endpoint (according to Q.2767.1)		Called party soft PVPC or PVCC
PVC calling endpoint (according to Q2767.1)		Calling party soft PVPC or PVCC
Propagation delay counter Maximum end-to-end transit delay (Note 4)		End-to-end transit delay
OAM traffic descriptor		Not carried
Application generated identifier (according to Q.2726.4), (Note 11)		Generic identifier transport
Minimum ATM cell rate (according to Q.2725.1)		Minimum acceptable ATM traffic descriptor
Notification		Notification indicator
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
Narrowband low layer compatibility		Narrowband low layer compatibility
Progress indicator (Note 7)		Progress indicator
QoS parameter (Q.2723.1)		QoS parameter (Note 5)
		Extended QoS parameters (Notes 9, 10)
Transit network selection (Note 6)		Transit network selection
User-to-user information		Not carried

NOTES

1. Contents of the Called party number information element starting with octet 5 are as in the AESA for called party parameter starting with octet 2. If the AESA for called party parameter is not present in the IAM, the E.164 number in the Called party number parameter is mapped to the IDI of the embedded E.164 AESA address in the Called party number information element, with the DSP set to all zeros. In this case, the type of number in the information element is set to "unknown" and the numbering plan identification is set to "AESA".

2. Contents of the Calling party number information element starting with octet 5 are as in the AESA for calling party parameter starting with octet 2. If the AESA for calling party parameter is not present in the IAM, but an Additional calling party number parameter with E.164 number is present, the E.164 number is mapped to the IDI

of the embedded E.164 AESA address in the Calling party number information element, with the various fields in the information element set as in Note 1. If only the Calling party number parameter with E.164 number is present, the E.164 is mapped as described for the Additional calling party number parameter. The presentation indicator and screening indicator are mapped directly.

3. The call is forwarded and the CUG discarded if the CUG call indicator in the parameter indicates "outgoing access"
    If the CUG call indicator indicates "call without outgoing access", the call shall be rejected with cause #29, "facility rejected" (This is done to maintain security).

4. The propagation delay counter is mapped to the cumulative transit delay subfield of the End-to-end transit delay information element.
    If the Maximum end-to-end transit delay parameter is present, its parameter field is mapped to the maximum end-to-end transit delay subfield of the information element, and the network-generated indicator is not included in the information element. If the Maximum end-to-end transit delay parameter is absent, the maximum end-to-end transit delay subfield in the information element is coded with the codepoint "any end-to-end transit delay value acceptable", and the network generated indicator is included.
    If the parameter field of the Maximum end-to-end transit delay parameter contains a cumulative value, which is greater than 16777 milliseconds, the call shall be rejected with cause #127 "interworking, not specified". If the parameter field of the Maximum end-to-end Transit delay parameter contains a maximum acceptable value, which is greater than 16777 milliseconds, the value 16777 milliseconds shall be used.

5. If the QoS parameter is not present, a QoS information element is created at the outgoing exchange using the codepoint "unspecified".

6. The call is forwarded only if the Transit network selection parameter contains type of network identification of "national" and network identification plan of "carrier identification code". If the parameter contains any other combination of values, the call shall be rejected with cause #91, "invalid transit network selection".

7. If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element.

8. The ATM cell rate parameter is mapped to the Peak cell rate subfield of the ATM traffic descriptor information element. The Additional ATM cell rate parameters are mapped to the other subfields of the ATM traffic descriptor information element.

9. When the ATM service category of the call is CBR, real-time VBR, or non-real-time VBR, as an option an Extended QoS parameters information element may be generated before progressing the call over the AINI interface. The Origin field in the Extended QoS parameters information element must be set to "intermediate network". The acceptable values of the individual QoS parameters in the Extended QoS parameters information element should be generated using a local mapping from the service category and the forward and backward QoS class fields in the QoS parameter. All individual QoS parameters for which values are implied (from the QoS classes included in the QoS parameter and the ATM service category of the call) should be specified. All cumulative parameter values generated from the mapping should be initialized to zero before beginning processing of the individual QoS parameters. These cumulative parameter values may subsequently be incremented to account for expected increases due to user data transfer within the preceding network over the related connection. For more details see section 3.5, "6.5.2.3.5/PNNI 1.0 QoS parameter selection procedures".

10. If the AINI is at the egress of an ASP network, and when the ATM service category of the call is CBR, real-time VBR, or non-real-time VBR, the Extended QoS parameters information element is always provided before progressing the call. For more details see section 3.5, "6.5.2.3.5/PNNI 1.0 QoS parameter selection procedures".

11. This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

4.1.1.2.2   Mapping of the ALERTING Message with the Call Progress Message (CPG)

4.1.1.2.2.1   B-ISUP to AINI

B-ISUP to AINI	
CPG	**ALERTING**
Called party's indicators : called party's status = "alerting"	

B-ISUP	to	AINI
CPG		ALERTING
Access delivery information		Not carried
Notification		Notification indicator
Application generated identifier (Note 1)		Generic identifier transport
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
In-band information indicator = "in-band information ... now available"		Progress indicator set to "in-band information ... now available"
Progress indicator (Note 2)		Progress indicator
User-to-user information		Not carried

Note 1: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element

4.1.1.2.2.2   AINI to B-ISUP

Not applicable.

4.1.1.2.3   Mapping of the ALERTING Message with the Address Complete Message (ACM)

4.1.1.2.3.1   AINI to B-ISUP

AINI	to	B-ISUP
ALERTING		ACM
		Called party's indicators: called party's status set to "alerting" called party's category set to "no indication"
Notification indicator		Notification
Generic identifier transport (Note 1)		Application generated identifier
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
Progress indicator (Note 2)		Progress indicator
Security services		Not carried
Generic application transport		Not carried (Note 3)

Note 1: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 2: The Progress indicator information element may be repeated. If the Progress indicator information element is repeated, all instances are mapped into a single Progress indicator parameter with the priority subfield set to "no prioritized order".

Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.1.2.3.2   B-ISUP to AINI

B-ISUP	to	AINI
ACM		ALERTING
Called party's indicators : called party's status = "alerting" (Note 1)		
Access delivery information		Not carried
Notification		Notification indicator
Application generated identifier (Note 3)		Generic identifier transport
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
In-band information indicator = "in-band information ... now available"		Progress indicator set to "in-band information ... now available"
Progress indicator(Note 2)		Progress indicator
User-to-user information		Not carried

Note 1: If called party's status is set to "no indication" then the ACM is not mapped.
Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element with the priority subfield set to "no prioritized order".
Note 3: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

4.1.1.2.4   Mapping of the CONNECT Message with the Answer Message (ANM)

4.1.1.2.4.1   AINI to B-ISUP

AINI	to	B-ISUP
CONNECT		ANM
AAL parameters		AAL parameters
ABR additional parameters		Not carried
ABR setup parameters		ABR setup parameters
ATM traffic descriptor		ATM cell rate
		Additional ATM cell rate
Broadband low layer information		Broadband low layer information
Called party soft PVPC or PVCC		PVC called endpoint
Connected number		AESA for connected party
		Connected number
Connected subaddress		Connected subaddress
End-to-end transit delay		Call history information
Extended QoS parameters		Not carried
Generic identifier transport (Note 1)		Application generated identifier
Narrowband high layer compatibility		Narrowband high layer compatibility
Narrowband low layer compatibility		Narrowband low layer compatibility
Notification indicator		Notification
Progress indicator (Note 2)		Progress indicator
Security services		Not carried
Generic application transport		Not carried (Note 3)

Note 1: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 2: The Progress indicator information element may be repeated. If the Progress indicator information element is repeated, all instances are mapped into a single Progress indicator parameter with the priority subfield set to "no prioritized order".

Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.1.2.4.2   B-ISUP to AINI

B-ISUP	**to**	**AINI**
ANM		**CONNECT**
AAL parameters		AAL parameters
ABR setup parameters		ABR setup parameters
Access delivery information		Not carried
Additional connected number		Not carried
ATM cell rate		ATM traffic descriptor
Additional ATM cell rate		
Broadband low layer information		Broadband low layer information
PVC called endpoint		Called party soft PVPC or PVCC
AESA for connected party		Connected number
Connected number		
Connected subaddress		Connected subaddress
Call history information		End-to-end transit delay
Application generated identifier (Note 1)		Generic identifier transport
Narrowband high layer compatibility		Narrowband high layer compatibility
Narrowband low layer compatibility		Narrowband low layer compatibility
Notification		Notification indicator
Progress indicator(Note 2)		Progress indicator
User-to-user information		Not carried

Note 1: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element.

4.1.1.2.5   Mapping of the NOTIFY Message with the Call Progress Message (CPG)

The mapping of the NOTIFY and the CPG messages is simple (practically one-to-one). No arrow diagrams are therefore provided.

4.1.1.2.5.1   AINI to B-ISUP

AINI	**to**	**B-ISUP**
NOTIFY		**CPG**
Notification indicator		Notification
Generic application transport		Not carried (Note)

Note: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.1.2.5.2   B-ISUP to AINI

B-ISUP	to	AINI
CPG		**NOTIFY**
Notification		Notification indicator

4.1.1.2.6   Mapping of the PROGRESS Message with the Call Progress Message (CPG)

The mapping of the PROGRESS and the CPG messages is one-to-one. No arrow diagrams are therefore provided.

4.1.1.2.6.1   AINI to B-ISUP

AINI	to	B-ISUP
PROGRESS		**CPG**
		Called party's indicators : called party's status = "no indication"
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
Notification indicator		Notification
Progress indicator (Note1)		Progress indicator
Generic application transport		Not carried (Note 2)

Note 1: The Progress indicator information element may be repeated. If the Progress indicator information element is repeated, all instances are mapped into a single Progress indicator parameter with the priority subfield set to "no prioritized order".

Note 2: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.1.2.6.2   B-ISUP to AINI

B-ISUP	to	AINI
CPG		**PROGRESS**
Called party's indicators : called party's status = "no indication"		
Application generated identifier		Not carried (Note 1)
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
Notification		Notification indicator
In-band information indicator = "in-band information ... now available"		Progress indicator set to "in-band information ... now available"
Progress indicator (Note 2)		Progress indicator
Access delivery information		Not carried
User-to-user information		Not carried

Note 1. The B-ISUP CPG message as currently defined in ITU-T Rec. Q.2726.4 has the capability to transport the Application generated identifier parameter, which is equivalent to the AINI Generic identifier transport information element. However, the AINI PROGRESS message does not have the capability to transport the Generic identifier transport information element.

Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element.

4.1.1.2.7   Mapping of the PROGRESS Message with the Address Complete Message (ACM)

4.1.1.2.7.1   AINI to B-ISUP

AINI	to	B-ISUP
PROGRESS		**ACM**
		Called party's indicators : called party's status = "no indication"
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
Notification indicator		Notification
Progress indicator (Note1)		Progress indicator
Generic application transport		Not carried (Note 2)

Note 1: The Progress indicator information element may be repeated. If the Progress indicator information element is repeated, all instances are mapped into a single Progress indicator parameter with the priority subfield set to "no prioritized order".

Note 2: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.1.2.7.2   B-ISUP to AINI

B-ISUP	to	AINI
ACM		**PROGRESS**
Called party's indicators : called party's status = "no indication"		
Application generated identifier		Not carried (Note 1)
Narrowband bearer capability		Narrowband bearer capability
Narrowband high layer compatibility		Narrowband high layer compatibility
Notification		Notification indicator
In-band information indicator = "in-band information ... now available"		Progress indicator set to "in-band information ... now available"
Progress indicator (Note 2)		Progress indicator
Access delivery information		Not carried
User-to-user information		Not carried

Note 1. The B-ISUP ACM message as currently defined in ITU-T Rec. Q.2726.4 has the capability to transport the Application generated identifier parameter, which is equivalent to the AINI generated Generic identifier transport information element. However, the AINI PROGRESS message does not have the capability to transport the Generic identifier transport information element.

Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element.

4.1.2 Interworking specification for call release procedures

4.1.2.1 Arrow diagrams

No arrow diagrams are provided since the mapping is straightforward.

4.1.2.2 Mapping tables

This section contains the mapping tables, associated parameters, and information elements for normal call release.

4.1.2.2.1 Mapping of the RELEASE Message with the Release Message (REL)

4.1.2.2.1.1 AINI to B-ISUP

AINI to	B-ISUP
RELEASE	**REL**
Cause	Cause indicators
Generic identifier transport (Note 1)	Application generated identifier
Notification indicator	Notification
Progress indicator (Note 2)	Progress indicator
Security services	Not carried
Generic application transport	Not carried (Note 3)

Note 1: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 2: The Progress indicator information element may be repeated. If repeated, all instances are mapped into a single Progress indicator parameter with the priority subfield set to "no prioritized order".

Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.2.2.1.2 B-ISUP to AINI

B-ISUP to	AINI
REL	**RELEASE**
Access delivery information	Not carried
Cause indicators	Cause
Application generated identifier (Note 1)	Generic identifier transport
Notification	Notification indicator
Progress indicator (Note 2)	Progress indicator
User-to-user information	Not carried

Note 1: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element.

4.1.3   Interworking specification for unsuccessful call set-up procedures

4.1.3.1   Arrow diagrams

This section contains the interworking arrow diagrams for the unsuccessful call set-up procedures.
For those messages that are not mapped, for clarification, an "X" precedes the arrowhead.
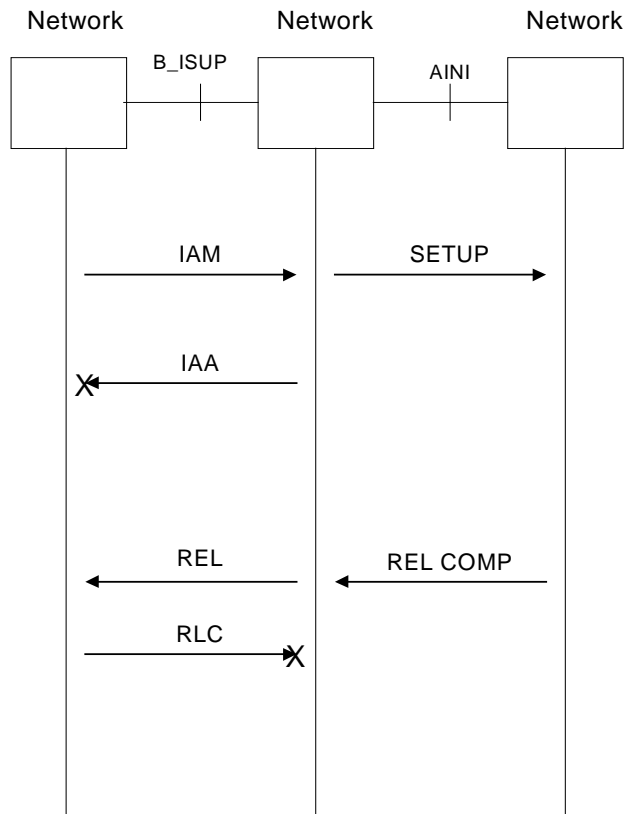
Figure 4-10: Unsuccessful call set-up (B-ISUP → AINI)
REL COMP, no CALL PROC received
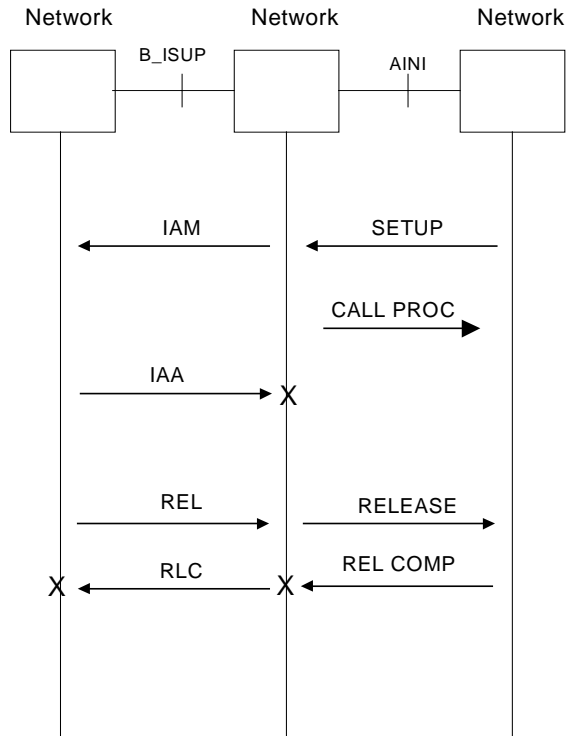
Figure 4-11: Unsuccessful call set-up (AINI → B-ISUP)
IAA received, CALL PROC sent, REL received at the B-ISUP side
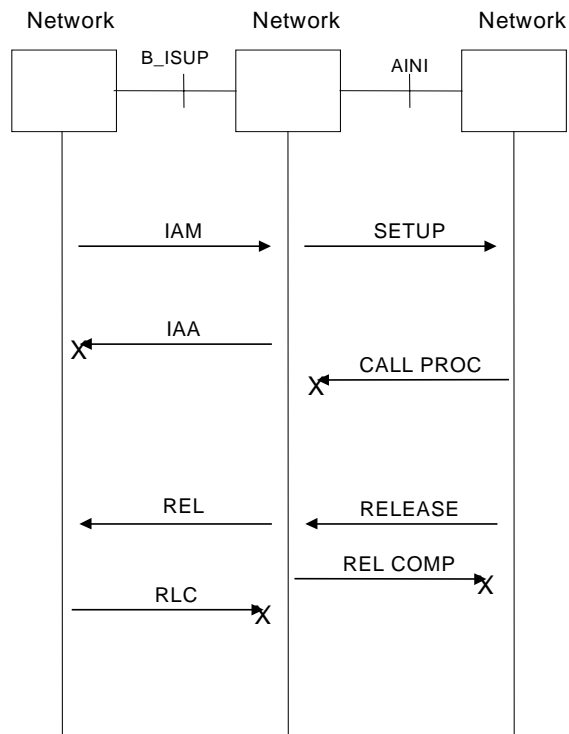
Figure 4-12: Unsuccessful call set-up (B-ISUP → AINI)
CALL PROC sent, RELEASE received at the AINI side
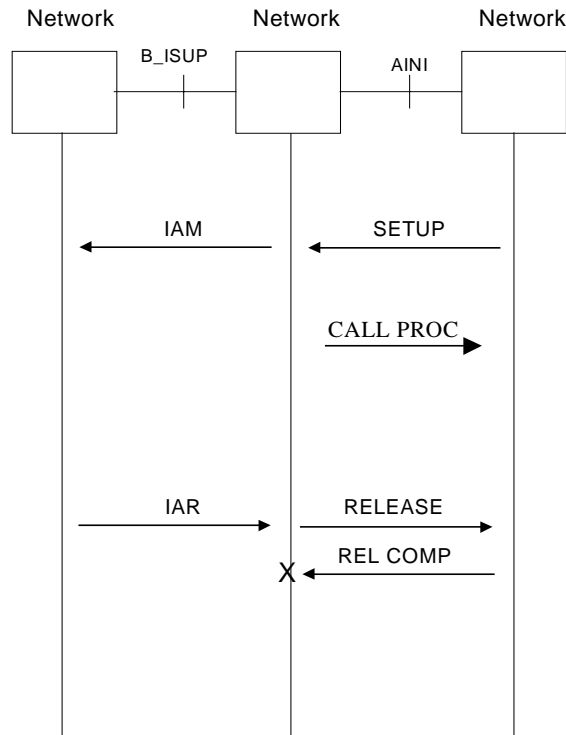
Figure 4-13: Unsuccessful call set-up (AINI → B-ISUP)
IAR received

4.1.3.2   Mapping tables

4.1.3.2.1   Mapping of the Release Complete Message (REL COMP) with the Release Message (REL)

4.1.3.2.1.1   AINI to B-ISUP

AINI	to	B-ISUP
REL COMP	**REL**	
Cause	Cause indicators	
Crankback	Not carried	
Generic application transport	Not carried (Note)	

Note: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.3.2.1.2   B-ISUP to AINI

Not applicable.

4.1.3.2.2 **Mapping of the RELEASE Message with the Release Message (REL)**

4.1.3.2.2.1 AINI to B-ISUP

AINI	to	B-ISUP
RELEASE		**REL**
Cause		Cause indicators
Generic identifier transport (Note 1)		Application generated identifier
Notification indicator		Notification
Progress indicator (Note 2)		Progress indicator
Crankback		Not carried
Security services		Not carried
Generic application transport		Not carried (Note 3)

Note 1: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 2: The Progress indicator information element may be repeated. If repeated, all instances are mapped into a single Progress indicator parameter with the priority subfield set to "no prioritized order".

Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.3.2.2.2 B-ISUP to AINI

B-ISUP	to	AINI
REL		**RELEASE**
Access delivery information		Not carried
Cause indicators		Cause
Application generated identifier (Note 1)		Generic identifier transport
Notification		Notification indicator
Progress indicator(Note 2)		Progress indicator
User-to-user information		Not carried

Note 1: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 2: If the Progress indicator parameter contains multiple progress indicators, each of these will be mapped to a separate Progress indicator information element.

4.1.3.2.3 **Mapping of the RELEASE Message with the IAM Reject Message (IAR)**

4.1.3.2.3.1 AINI to B-ISUP

Not applicable.

4.1.3.2.3.2   B-ISUP to AINI

B-ISUP	to	AINI
IAR	**RELEASE**	
Automatic congestion level	Not carried	
Cause indicator	Cause	

4.1.4　Interworking specification for point–to-multipoint calls

For the description of the interworking between AINI and B-ISUP for point-to-multipoint calls/connections, the following is applicable:

1.　Only the information element/parameter mappings, which are additional to point-to-point call/connection control, are described.

2.　It is assumed that the following capabilities are not applicable with point-to-multipoint calls/connections:
　　- Available Bit Rate (ABR);
　　- Negotiation;
　　- Soft PVPC and Switched VPC.

3.　The mapping tables are based on ITU-T Recommendation Q.2722.1.

Note:
In B-ISUP, the mapping, and the action taken when receiving a message depends on whether the B-ISUP side is the preceding or the succeeding side in the call set-up path.
Preceding in the context of point-to-multipoint calls means that the root of the call is somewhere "behind or prior" to the B-ISUP side of the AINI.
For this reason, the presentation of the mapping tables is structured accordingly. In ITU Recommendation Q.2722.1 this corresponds to the "Originating Exchange" (= Preceding Side) and "Destination Exchange" (= Succeeding Side). Recommendation Q.2722.1 employs the same way of presenting and structuring the mapping tables.

4.1.4.1　Arrow diagrams

This section contains the interworking arrow diagrams for the typical point-to-multipoint call/connection scenarios.

For those messages that are not mapped, for clarification, an "X" precedes the arrowhead.
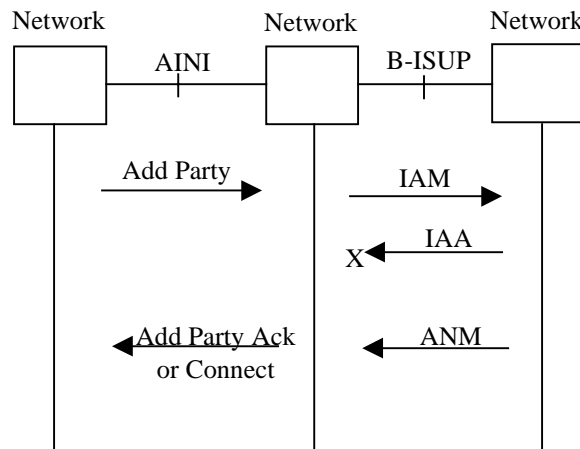
Figure 4-14: Adding a subsequent party (AINI → B-ISUP)
No alerting and no ACM
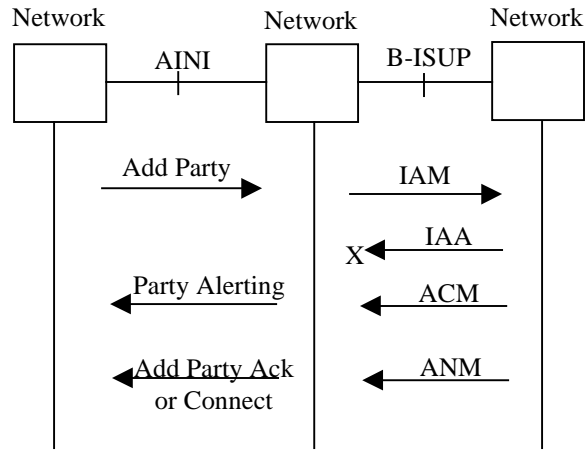
Figure 4-15: Adding a subsequent party (AINI → B-ISUP)
ACM indicates "alerting"
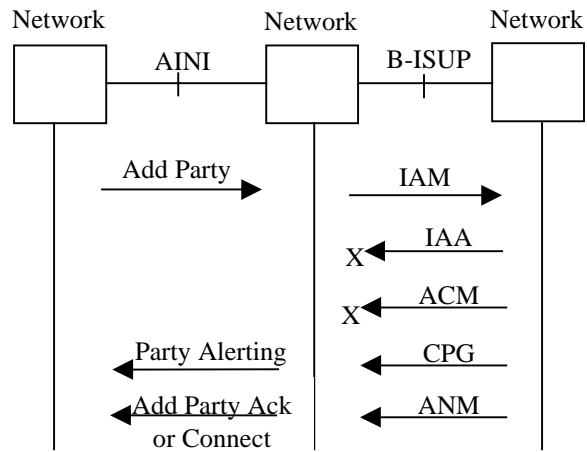
Figure 4-16: Adding a subsequent party (AINI → B-ISUP)
ACM does not indicate "alerting"
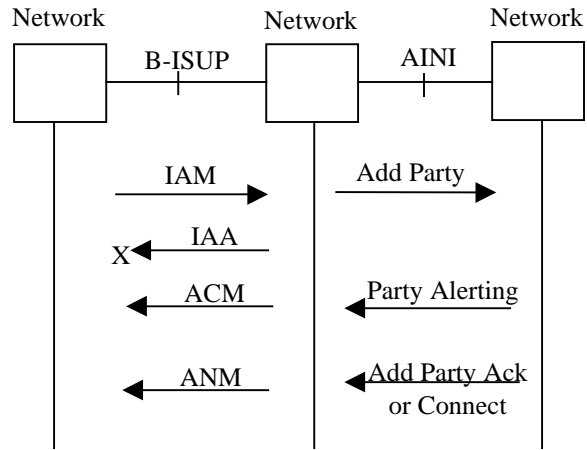
Figure 4-17: Adding a subsequent party (B-ISUP → AINI)
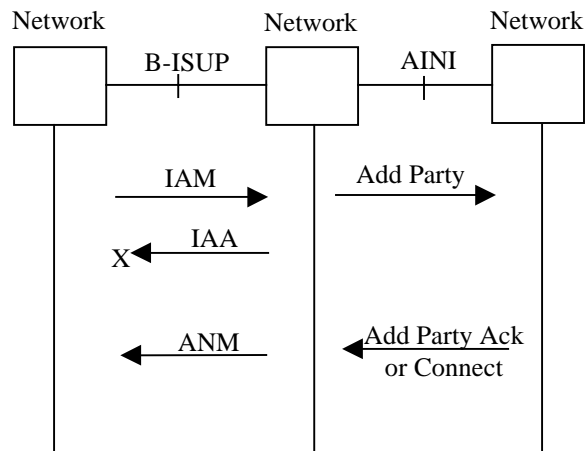
Figure 4-18: Adding a subsequent party (B-ISUP → AINI)
No alerting and no ACM
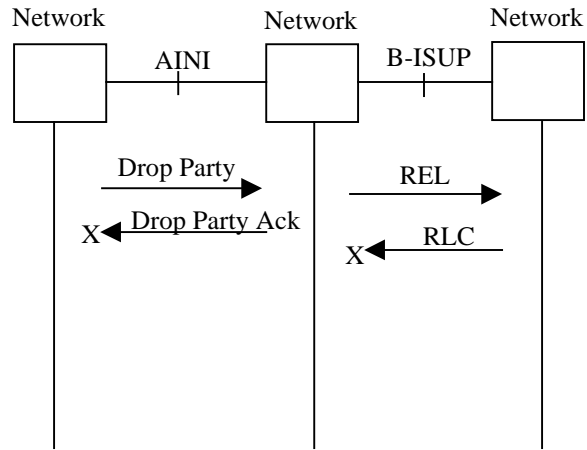
Figure 4-19: Dropping a party (AINI → B-ISUP)
Not for the last party in the call/connection
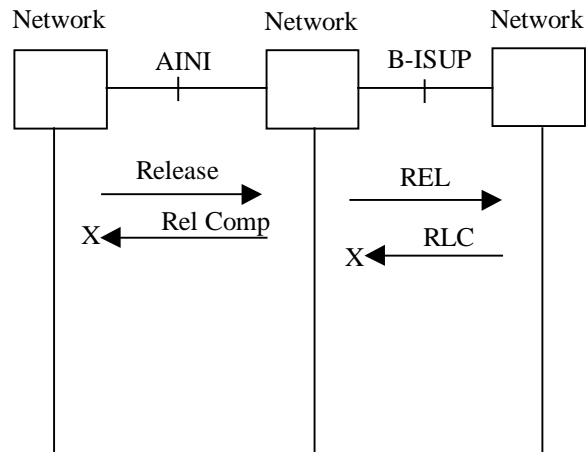
Figure 4-20: En bloc release (AINI → B-ISUP)
B-ISUP release messages are sent for each outgoing connection link instance
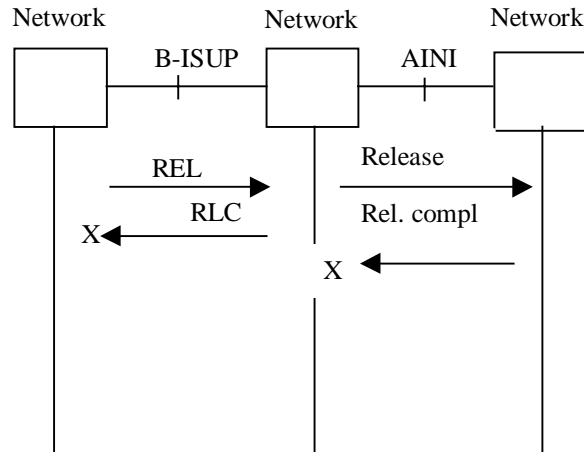
Figure 4-21: En bloc release (B-ISUP → AINI)
REL contains Destination connection link identifier.
AINI release messages are sent on each access associated
with the incoming B-ISUP connection link object instance
(This diagram applies only if the root is "behind the B-ISUP",
i.e. if the B-ISUP is the preceding side)
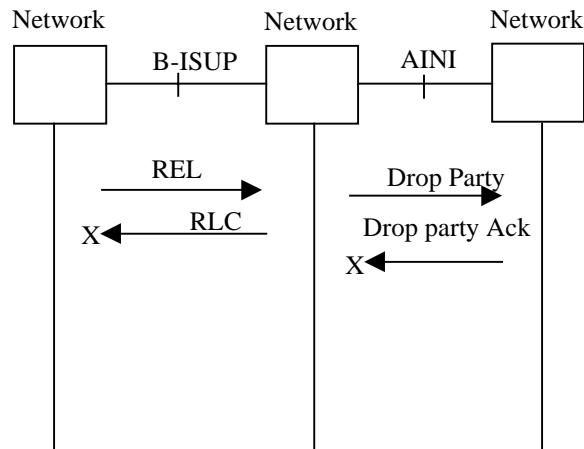
Figure 4-22: Dropping a party (B-ISUP → AINI)
Not for the last party in the call/connection

4.1.4.2 Mapping tables for call setup from AINI to B-ISUP (B-ISUP is Succeeding Side)

This section contains the mapping tables of messages and associated parameters and information elements.

Note that the arrows in the mapping tables refer to arrow diagrams above.

4.1.4.2.1 Sending of IAM

4.1.4.2.1.1 Receipt of SETUP

Note: In case the SETUP contains an N-BC information element, the setup request is rejected.

AINI ⟶	B-ISUP
SETUP	**IAM**
	Origination connection link identifier (Note 1)
Broadband bearer capability: user plane configuration = "point-to-multipoint"	Broadband bearer capability
	Leaf party type (Note 2)
Endpoint reference (Note 3)	
Security services	Not carried
Generic application transport	Not carried (Note 4)

Note 1: A new outgoing B-ISUP Connection link object instance and a new outgoing B-ISUP Application Entity Instance (AEI) are created, i.e., a new virtual channel link is created.
An exchange internal association has to be created between the AINI call instance and the B-ISUP Connection link object instance (Call reference value ↔ Connection link identifier value).

Note 2: If the Endpoint reference value is zero then the Leaf party type is set to "First endpoint of type 2 connection" or else it is set to "subsequent endpoint of type 2 connection".

Note 3: An exchange internal association has to be created between the AINI party/endpoint and the related outgoing B-ISUP AEI (Endpoint reference value ↔ Signalling identifier value (SID)).

Note 4: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.2.1.2 Receipt of ADD PARTY

AINI ⟶	B-ISUP
ADD PARTY	**IAM**
	Either (Note 1) origination connection link identifier (Note 2); or Destination connection link identifier (Note 3)
	ATM cell rate (Note 4)
	Additional ATM cell rate (Note 4)
	Broadband bearer capability (Note 4)
AAL parameters	AAL parameters
Broadband high layer information	Broadband high layer information
Broadband low layer information (Note 8)	Broadband low layer information

AINI ⟶	B-ISUP
ADD PARTY	**IAM**
Called party number	Called party number
	AESA for called party
Called party subaddress (Note 10)	Called party subaddress
Called party soft PVPC/PVCC (Note 13)	PVC called endpoint
Calling party number	Calling party number
	AESA for calling party number
	Additional calling party number
Calling party soft PVPC/PVCC (Note 13)	PVC calling endpoint
Calling party subaddress (Note 11)	Calling party subaddress
	Calling party's category (Note 9)
	Connected line identity request
	Leaf party type (Note 5)
Endpoint reference (Note 6)	
End-to-end transit delay	Propagation delay counter
	Maximum end-to-end transit delay (Note 7)
Generic identifier transport (Note 12)	Application generated identifier
Notification indicator	Notification
Transit network selection	Transit network selection
	QoS parameter (Note 4)
Transported address stack	Not carried (Note 14)
Generic application transport	Not carried (Note 15)
Security services	Not carried

Note 1: The choice depends on the routing result. In both cases a new outgoing B-ISUP AEI (i.e., signalling association) is created.

Note 2: The Originating connection link identifier is included if a new outgoing B-ISUP Connection link object instance is created (i.e., a new virtual channel link is created for that party).
An exchange internal association has to be created between the AINI call instance and this B-ISUP Connection link object instance (Call reference value ↔ Connection link identifier value).
Furthermore, the exchange has to invoke a cell replication function in the user plane.

Note 3: The Destination connection link identifier is included if an existing outgoing B-ISUP connection link object instance is used (i.e. an existing Virtual Channel link is shared with previous parties).

Note 4: Those parameters are retrieved from the stored call information.

Note 5: The Leaf party type parameter is set to "Subsequent endpoint of type 2 connection".

Note 6: An exchange internal association has to be created between the AINI party/endpoint and the related outgoing B-ISUP AEI (Endpoint reference value ↔ Signalling identifier value (SID)).

Note 7: The Cumulative end-to-end transit delay subfield of the End-to-end transit delay information element is mapped to the Propagation delay counter parameter. The Maximum end-to-end transit delay subfield is mapped to the Maximum end-to-end transit delay parameter only if the Network-generated indicator is not present in the End-to-end transit delay information element. Further, if the End-to-end transit delay information element is not present, the Propagation delay counter parameter has to be created since it is mandatory for B-ISUP.

Note 8: The Broadband low layer information element may be repeated in the IAM but is not repeated in the ADD PARTY message

Note 9: This parameter must be included in the IAM since it is a mandatory parameter.

Note 10: The Called party subaddress information element may be repeated. If repeated, the ADD PARTY request shall be rejected with cause #127, "interworking, unspecified".

Note 11: The Calling party subaddress information element may be repeated. If repeated, the first instance of the information element shall be mapped to the Calling party subaddress parameter if the first instance is an AESA. Otherwise, the second instance shall be mapped. The instance of the information element that is not mapped shall be dropped.

Note 12: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 13: At the AINI, the Soft PVCC feature is supported for point-to-multipoint calls, the Soft PVPC feature is not (cf. section 4.1.4).

Note 14: If one or more Transported address stack information elements are included, the call shall be rejected with cause #127, "interworking, unspecified".

Note 15: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.2.2   Receipt of ACM

4.1.4.2.2.1   Sending of ALERTING

This mapping applies if there is only one associated call instance at the AINI.

AINI ←———————————— B-ISUP	
ALERTING	**ACM**
	Called party's indicators: called party status set to "alerting" (Note 1)
Endpoint reference (Note2)	

Note 1: If called party's status is set to "no indication", the ACM is not mapped.

Note 2: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (i.e., signalling association).

4.1.4.2.2.2   Sending of PARTY ALERTING

This mapping applies if there is more than one associated call instance at the AINI.

AINI ←———————————— B-ISUP	
PARTY ALERTING	**ACM**
	Called party's indicators: called party status set to "alerting" (Note 1)
Not carried	Access delivery information
Endpoint reference (Note 2)	
Generic identifier transport	Application generated identifier (Note 3)
Notification indicator	Notification
Not carried	User-to-user information

Note 1: If called party's status equals "no indication", the ACM is not mapped.

Note 2: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (i.e., signalling association).

Note 3: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

4.1.4.2.3   Receipt of CPG

4.1.4.2.3.1   Sending of ALERTING

This mapping applies if there is only one associated call instance at the AINI.

AINI ⟵	B-ISUP
ALERTING	**CPG**
Endpoint reference (Note)	

Note: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (signalling association).

4.1.4.2.3.2   Sending of PARTY ALERTING

This mapping applies if there is more than one associated call instance at the AINI.

AINI ⟵	B-ISUP
PARTY ALERTING	**CPG**
Not carried	Access delivery information
	Called party's indicators: called party status = "alerting"
Endpoint reference (Note 1)	
Notification indicator	Notification
Not carried	User-to-user information
Generic identifier transport	Application generated identifier (Note 2)

Note 1: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (signalling association).

Note 2: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

4.1.4.2.4   Receipt of ANM

4.1.4.2.4.1   Sending of CONNECT

This mapping applies if there is only one associated call instance at the AINI.

AINI ⟵	B-ISUP
CONNECT	**ANM**
Endpoint reference (Note)	

Note: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (signalling association).

4.1.4.2.4.2   Sending of ADD PARTY ACKNOWLEDGE

This mapping applies if there is more than one associated call instance at the AINI.

AINI ⟵	B-ISUP
ADD PARTY ACKNOWLEDGE	**ANM**
AAL parameters	AAL parameters
Not carried	Access delivery information
	ATM cell rate
	Additional ATM cell rate
Called party soft PVPC/PVCC (Note 3)	PVC called endpoint
Connected number	AESA for connected party
	Connected number
	Additional connected number
Connected subaddress	Connected subaddress
Broadband low layer information	Broadband low layer information
Endpoint reference (Note 1)	
End-to-end transit delay	Call history information
Notification indicator	Notification
Not carried	User-to-user information
Generic identifier transport	Application generated identifier (Note 2)

Note 1: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (signalling association).

Note 2**:** This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 3: At the AINI, the Soft PVCC feature is supported for point-to-multipoint calls, the Soft PVPC feature is not (cf. section 4.1.4)

4.1.4.2.5   Receipt of REL

4.1.4.2.5.1   Sending of RELEASE

This mapping applies if there is only one associated call instance at the AINI.

AINI ⟵	B-ISUP
RELEASE	**REL**

4.1.4.2.5.2   Sending of DROP PARTY

This mapping applies if there is more than one associated call instance at the AINI and the party concerned is in the Party alerting delivered or Active state.

AINI ←	B-ISUP
DROP PARTY	**REL**
Cause	Cause indicators
Generic identifier transport	Application generated identifier (Note 1)
Endpoint reference (Note 2)	
Notification indicator	Notification
Not carried	User-to-user information

Note 1: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 2: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (signalling association).

4.1.4.2.5.3   Sending of ADD PARTY REJECT

This mapping applies if there is more than one associated call instance at the AINI and the party concerned is in the Add party received state.

AINI ←	B-ISUP
ADD PARTY REJECT	**REL**
Cause	Cause indicators
Generic identifier transport	Application generated identifier (Note 1)
Endpoint reference (Note 2)	
Not carried	User-to-user information

Note 1: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 2: The Endpoint reference has to be set to the value, which has been associated with the SID of the outgoing B-ISUP AEI (signalling association).

4.1.4.2.6   Sending of REL

4.1.4.2.6.1   Receipt of RELEASE *(en bloc* release)

AINI →	B-ISUP
RELEASE	**REL (Note)**
	Destination connection link identifier

Note: The B-ISUP message is repeated for all Outgoing connection link object instances which are associated with the call (en bloc release).

4.1.4.2.6.2   Receipt of DROP PARTY

AINI ─────────────────────────────▶ B-ISUP	
DROP PARTY	**REL**
Cause	Cause indicators
Endpoint reference (Note 1)	
Generic identifier transport (Note 2)	Application generated identifier
Notification indicator	Notification
Security services	Not carried
Generic application transport	Not carried (Note 3)

Note 1: The Endpoint reference is used to identify the associated SID of the outgoing B-ISUP AEI (signalling association).

Note 2: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3   Mapping tables for call setup from B-ISUP to AINI (B-ISUP is Preceding Side)

4.1.4.3.1   Receipt of IAM

4.1.4.3.1.1   Sending of SETUP

This mapping applies if the new party is to be added at the AINI with no call instance yet associated with the incoming B-ISUP Connection link instance.

B-ISUP ───────────────────────────────▶ AINI	
IAM	**SETUP**
Broadband Bearer Capability indicates "point-to-multipoint" either Origination connection link identifier (Note 1); or Destination connection link identifier (Note 2); or (no identifier included) (Note 3)	
Leaf party type	
	Endpoint reference (Note 4)

Note 1: In this case a new incoming B-ISUP Connection link object instance, a new incoming B-ISUP AEI (signalling association) is created and at the access a new AINI call instance is created. The following exchange internal associations have to be created:
–   Incoming B-ISUP Connection link object instance ↔ AINI call instance
     (i.e. Connection link identifier value ↔ Call reference value).
–   Incoming B-ISUP AEI ↔ AINI party/endpoint
     (i.e. Signalling identifier value ↔ Endpoint reference value).

Note 2: If the Destination connection link identifier is included, this means that an incoming B-ISUP Connection link object instance (and at least one associated AINI call instance) already exists.

Further processing is as follows:

A new AINI call instance is created and the following exchange internal associations have to be created:

– Incoming B-ISUP Connection link object instance ↔ AINI Call instance

(i.e. Connection link identifier value ↔ Call reference value).

– Incoming B-ISUP AEI ↔ AINI party/endpoint

(i.e. Signalling identifier value ↔ Endpoint reference value).

Furthermore, the exchange has to invoke a cell replication function in the user plane.

Note 3: If no Connection link identifier is included the interworking proceeds as for Note 1.

Note 4: The value of the Endpoint reference has to be set to zero if the Leaf party type is set to "First endpoint of type 2 connection" otherwise it is locally assigned a non-zero value.

4.1.4.3.1.2   Sending of ADD PARTY

This mapping applies if the new party is to be added at the AINI and a call instance associated with the incoming B-ISUP Connection link object instance already exists.

B-ISUP ⟶	AINI
IAM	**ADD PARTY**
Destination connection link identifier	
ATM cell rate	
Additional ATM cell rate	
Broadband bearer capability	
AAL parameters	AAL parameters
Broadband high layer information	Broadband high layer information
Broadband low layer information (Note 1)	Broadband low layer information
Called party number	Called party number
AESA for called party	
Called party subaddress	Called party subaddress
Calling party number	Calling party number
AESA for calling party	
Additional calling party number	
Calling party subaddress	Calling party subaddress
Calling party's category	Not carried
Connected line identity request	Not carried
Closed user group information	Not carried
Priority	Not carried
Leaf party type (Note 2)	
	Endpoint reference (Note 3)
Application generated identifier (Note 5)	Generic identifier transport
Propagation delay counter; and Maximum end-to-end transit delay (Note 4)	End-to-end transit delay
Transit network selection	Transit network selection
QoS parameter	
Notification	Notification indicator
User-to-user information	Not carried

Note 1: The Broadband low layer information element may be repeated in the IAM but is not repeated in the ADD PARTY message

Note 2: The Leaf party type parameter is set to "Subsequent endpoint of type 2 connection".

Note 3: An exchange internal association has to be created between the AINI party/endpoint and the related incoming B-ISUP AEI (Endpoint reference value ↔ Signalling identifier value (SID)).

The value of the Endpoint reference is locally assigned and non-zero.

Note 4: The Propagation delay counter is mapped to the Cumulative transit delay subfield of the End-to-end transit delay information element. If the Maximum end-to-end transit delay parameter is present, its parameter field is mapped to the Maximum end-to-end transit delay subfield of the information element, and the Network-generated indicator is not included in the information element. If the Maximum end-to-end transit delay parameter is absent, the Maximum end-to-end transit delay subfield in the information element is coded with the codepoint "any end-to-end transit delay value acceptable", and the Network generated indicator is included.

Note 5: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

Note 6: The following notes to section 4.1.1.2.1.2 (mapping of IAM to SETUP) also apply for the mapping of IAM to ADD PARTY:
Note 1, Note2, Note 3, Note 4 and Note 6

4.1.4.3.2   Sending of ACM

4.1.4.3.2.1   Receipt of ALERTING

B-ISUP ◄——————————— AINI	
ACM	**ALERTING**
	Endpoint reference (Note 1)
Not carried	Security services
Not carried (Note 2)	Generic application transport

Note 1: The Endpoint reference value has an exchange internal association with the incoming B-ISUP AEI (signalling association), i.e., indirectly identifies the AEI where the B-ISUP message has to be sent.

Note 2: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.2.2   Receipt of PARTY ALERTING

B-ISUP ◄——————————— AINI	
ACM	**PARTY ALERTING**
Called party's indicators: called party status = "alerting"	
	Endpoint reference (Note 1)
Application generated identifier	Generic identifier transport (Note 2)
Not carried	Security services
Not carried (Note 3)	Generic application transport

Note 1: The Endpoint reference value has an exchange internal association with the incoming B-ISUP AEI (signalling association), i.e., indirectly identifies the AEI where the B-ISUP message has to be sent.

Note 2: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".

Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.3   Sending of ANM

4.1.4.3.3.1   Receipt of CONNECT

B-ISUP ◄─────────────────── AINI	
ANM	**CONNECT**
	Endpoint reference (Note 1)
Not carried	Security services
Not carried (Note 2)	Generic application transport

Note 1: The Endpoint reference value has an exchange internal association with the incoming B-ISUP AEI
(signalling association), i.e., indirectly identifies the AEI where the B-ISUP message has to be sent.
Note 2: When the Generic application transport information element contains ISUP parameters, as an implementation
option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.3.2   Receipt of ADD PARTY ACKNOWLEDGE

B-ISUP ◄─────────────────── AINI	
ANM	**ADD PARTY ACKNOWLEDGE**
AAL parameters	AAL parameters
ATM cell rate	
Additional ATM cell rate	
Broadband low layer information	Broadband low layer information
AESA for connected party	Connected number
Connected number	
Connected subaddress	Connected subaddress
	Endpoint reference (Note 1)
Call history information	End-to-end transit delay
Notification	Notification indicator
Application generated identifier	Generic identifier transport (Note 2)
Not carried	Security services
Not carried (Note 3)	Generic application transport

Note 1: The Endpoint reference value has an exchange internal association with the incoming B-ISUP AEI
(signalling association), i.e., indirectly identifies the AEI where the B-ISUP message has to be sent.
Note 2: The Generic identifier transport information element may be repeated. If repeated, all instances of the
information element are mapped into a single Application generated identifier parameter. The priority
subfield in the parameter shall be set to "no prioritized order".
Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation
option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.4   Sending of REL

4.1.4.3.4.1   Receipt of RELEASE

The B-ISUP message is repeated for all incoming B-ISUP AEIs, which are associated with the AINI call, instance.

B-ISUP ←	AINI
REL	**RELEASE**
Not carried	Security services
Not carried (Note)	Generic application transport

Note: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.4.2   Receipt of RELEASE COMPLETE

The B-ISUP message is repeated for all incoming B-ISUP AEIs, which are associated with the AINI call, instance.

B-ISUP ←	AINI
REL	**RELEASE COMPLETE**
Not carried (Note)	Generic application transport

Note: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.4.3   Receipt of DROP PARTY

B-ISUP ←	AINI
REL	**DROP PARTY**
Cause indicators	Cause
	Endpoint reference (Note 1)
Notification	Notification indicator
Application generated identifier	Generic identifier transport (Note 2)
Not carried	Security services
Not carried (Note 3)	Generic application transport

Note 1: The B-ISUP REL message is sent via the incoming B-ISUP AEI which is associated with the party (Endpoint reference value) which drops off the point-to-multipoint connection.
Note 2: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".
Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.4.4   Receipt of ADD PARTY REJECT

B-ISUP ⬅	AINI
REL	**ADD PARTY REJECT**
Cause indicators	Cause
	Endpoint reference (Note 1)
Not carried	Crankback
Application generated identifier	Generic identifier transport (Note 2)
Not carried	Security services
Not carried (Note 3)	Generic application transport

Note 1: The B-ISUP REL message is sent via the incoming B-ISUP AEI which is associated with the Endpoint reference value which rejects the add party operation.
Note 2: The Generic identifier transport information element may be repeated. If repeated, all instances of the information element are mapped into a single Application generated identifier parameter. The priority subfield in the parameter shall be set to "no prioritized order".
Note 3: When the Generic application transport information element contains ISUP parameters, as an implementation option, it is not precluded to interwork the ISUP parameters to B-ISUP.

4.1.4.3.5   Receipt of REL

4.1.4.3.5.1   Sending of RELEASE

This mapping applies if the Destination connection link identifier is included in the REL message or for the case where only one party exists within an associated call instance at the AINI.

B-ISUP ➡	AINI
REL	**RELEASE**
Destination connection link identifier (Note 1); or (no identifier included) (Note 2)	

Note 1: All parties associated with the incoming B-ISUP connection link object instance will be dropped (i.e. a RELEASE message is sent on each associated access).
Note 2: This applies for the case where only one party exists within an associated call instance at the access.

4.1.4.3.5.2   Sending of DROP PARTY

This mapping applies if the Destination connection link identifier is not included in the REL message and more than one party exists within an associated call instance at the AINI.

B-ISUP ➡	AINI
REL	**DROP PARTY**
Cause indicators	Cause
	Endpoint reference (Note 1)
Application generated identifier (Note 2)	Generic identifier transport
Notification	Notification indicator
User-to-user information	Not carried

Note 1: The party identified by the Endpoint reference value is dropped.
The Endpoint reference value has an exchange internal association with the incoming B-ISUP AEI (signalling association), i.e., indirectly identifies the AEI where the B-ISUP message has to be sent.

Note 2: This parameter carries one or more instances of the Generic identifier transport information. These are mapped unaltered and in the same order as they appear in the parameter to separate instances of the Generic identifier transport information element.

4.2   Interworking between AINI and PNNI

This section specifies the protocol interworking between PNNI and the ATM Inter-Network Interface.

4.2.1   Mapping of messages:

All PNNI 1.0 messages are mapped to their equivalent counterparts in AINI, and all AINI messages are mapped to their equivalent counterparts in PNNI 1.0, except those which are of local significance only. Note that messages with local significance are not forwarded between an AINI and a PNNI interface and so there is no need to specify an interworking.
According to section 6.3 of PNNI 1.0 the following messages are of local significance:

- STATUS ENQUIRY
- STATUS
- RESTART
- RESTART ACKNOWLEDGE
- CALL PROCEEDING
- RELEASE COMPLETE (Note)
- DROP PARTY ACKNOWLEDGE

Note: This message may carry information of global significance when used as the first call-clearing message. As such, it is translated to the RELEASE message when the call is cleared in the backward direction towards the calling user.

4.2.2   Mapping of information elements:

4.2.2.1   Information elements of local significance

The following Information Elements are of local (link-by-link) significance and are not mapped. Note that information elements with local significance are not forwarded between an AINI and a PNNI interface and so there is no need to specify an interworking

- Call state
- Endpoint reference
- Endpoint state
- Connection identifier
- Restart indicator

4.2.2.2   Information elements that are not supported

The following PNNI 1.0 Information Elements are not supported at the AINI and are not carried at the AINI:

- Designated transit list (DTL)
- Connection scope selection

4.2.2.3   Mapping of the Crankback information element

The format of the Crankback information element in PNNI Signalling 1.0 is different from that in AINI (see section 3.5, subsection "6.4.6.3/PNNI 1.0 Crankback"). Therefore, no one-to-one mapping is applicable at the interworking points.
The exact mapping is shown in the following two tables.

4.2.2.3.1   Mapping of the Crankback information element from AINI to PNNI

The fields within the transmitted PNNI Crankback information element are coded as follows:

Crankback Field	Octet	Contents
Crankback level	5	PNNI level of the DTL terminator
Blocked transit type	6	blocked link
Blocked link's preceding node identifier (from Blocked transit identifier)	6.1 to 6.22	PNNI NodeId of the DTL terminator. This is the last NodeId of the topmost DTL received in the original setup indication from the PNNI network.
Blocked link's port identifier (from Blocked transit identifier)	6.23 to 6.26	The last PNNI PortId of the topmost DTL received in the original setup indication from the PNNI network
Blocked link's succeeding node identifier (from Blocked transit identifier)	6.27 to 6.48	PNNI NodeId of all zeroes
Crankback cause	7	Crankback cause from the received AINI Crankback information element
Crankback cause diagnostics	7.1 etc.	omitted

4.2.2.3.2   Mapping of the Crankback information element from PNNI to AINI

The fields within the transmitted AINI Crankback information element are set as follows:

Crankback Field	Octet	Contents
Crankback level	5	255
Blocked transit type	6	call has blocked at or beyond the succeeding node
Blocked transit identifier	6.1 etc.	omitted
Crankback cause	7	Crankback cause from the received PNNI Crankback information element (Note)
Crankback cause diagnostics	7.1 etc.	omitted

Note: PNNI Crankback cause codes are mapped to their AINI equivalent values with the following exceptions:
       #128 "next node unreachable" is mapped to #3 "destination unreachable";
       #160 "DTL Transit not my node ID" is mapped to #45 "no VPI/VCI available".

4.2.2.4   Other information elements

All other information elements are mapped to their equivalent counterparts.

5   References

1.   ATM Forum, af-sig-0061.000 (1996), *ATM User-Network Interface (UNI) Signalling Specification Version 4.0.*

2.   ATM Forum, af-pnni-0055.000 (1996), *Private Network-Network Interface Specification version 1.0 (PNNI 1.0).*

3.   ATM Forum, af-pnni-0075.000 (1997), *PNNI ABR Addendum.*

4.   ATM Forum, af-pnni-0081.000 (1997), *PNNI v1.0 Errata and PICS.*

5.   ATM Forum, af-ra-0105.000 (1999), *ATM Forum Addressing: User Guide.*

6.   ATM Forum, af-ra-0106.000. (1999), *ATM Forum Addressing: Reference Guide.*

7.   ATM Forum, af-ra-0107.000 (1999), *Addressing Addendum for UNI Signalling 4.0.*

8.   ATM Forum, af-cs-0127.000 (1999), *PNNI SPVC Addendum version 1.0.*

9.   ATM Forum, af-cs-0126.000 (1999), *PNNI Addendum for Generic Application Transport Version 1.0.*

10.   ATM-Forum, af-cs-0115.000 (1999*), PNNI Transported Address Stack Version 1.0.*

11.   ATM Forum, af-cs-0116.000 (1999*), PNNI Version 1.0 Security Signaling Addendum.*

12.   ITU-T, Recommendation Q.2931 (1995), *Digital Subscriber Signalling System No. 2 (DSS 2) - User-Network Interface (UNI) Layer 3 Specification for Basic Call/Connection Control.*

13.   ITU-T, Recommendation Q.2763 (1995*), Signalling System No. 7 B-ISDN User Part (B-ISUP) - Formats and Codes.*

14.   ITU-T, Recommendation Q.2764 (1995*), Signalling System No. 7 B-ISDN User Part (B-ISUP) - Basic call procedures.*

15.   ITU-T, Recommendation Q.2650 (1995), *Interworking Between Signalling System No. 7/ Broadband ISDN User Part (B-ISUP) and Digital Subscriber Signalling System No. 2 (DSS2).*

16.   ITU-T, Recommendation Q.2726.1 (1996), *B-ISDN user part – ATM end system address*.

17.   ITU-T, Recommendation Q.2723.3 (1995), *Extensions to the B-ISDN User Part – Signalling capabilities to support traffic parameters for the Available Bit Rate (ABR).*

18.   ITU-T, Recommendation Q.2723.1 (1996*), B-ISDN User Part - Support of additional traffic parameters for Sustainable Cell Rate and Quality of Service.*

19.   ITU-T, Recommendation Q.2725.1 (1998), *B-ISDN User Part – Support of negotiation during connection setup.*

20.   ITU-T, Draft new Recommendation Q.2767.1 (May, 1998), *Soft PVC Capability.*

21.   ITU-T, Draft new Recommendation Q.2766.1 (May, 1998), *Switched Virtual Path Capability.*

22.   ITU-T, Recommendation Q.2941.1 (1997*), Digital subscriber Signalling System No. 2 – Generic identifier transport.*

23.   ITU-T, Recommendation Q.2726.4 (1997), *Extensions to the B-ISDN user part – Application generated identifiers.*

24.   ITU-T, Recommendation Q.2722.1 (1996), *B-ISDN User Part - Network Node Interface specification for point-to-multipoint call/connection control.*

6 Annex A: Procedures for Crankback

This section describes the additional clearing procedures and behavior of AINI during crankback. Crankback is indicated by including a Crankback information element in the first call-clearing message (RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT). These procedures are additional procedures to the clearing procedures described in Section 6.5.3/PNNI 1.0.
Note: This section corresponds to Annex B of PNNI version 1.0 and is adapted to the specific requirements of AINI.

6.1 Scope of Crankback procedures

A call received over an AINI signalling link that cannot be progressed beyond the receiving node may be subject to crankback. This specification indicates those cases where crankback is required. Whenever the specification indicates call clearing with specific cause codes, crankback shall not be performed unless stated explicitly.
Any call that progresses all the way to the called user and gets rejected by the called user will not be cranked back. This includes rejections by the called user that happen when a problem is discovered at the called user's end of the UNI, as well as rejections from within the endpoint or user system. In such cases, a RELEASE or RELEASE COMPLETE message with a Cause information element will be returned. This will result in the call being cleared all the way back to the calling user. These are not crankback situations, and no alternate routing is to be attempted in these cases.
Calls that get rejected when the node at which the subscriber is homed determines that the UNI to the called user cannot carry the call may be cranked back, similarly to cases where call rejection occurs at AINI interfaces, but in these cases crankback is not required.
The cases where crankback is used in AINI fall into two categories:

1. Reachability errors
2. Resource errors

In addition to these categories, it is possible for a call to be cranked back because the path selection at some node determines that there are no paths that meet the policy constraints. No specification of policy constraints is provided in this version of AINI, so definition of policy violations and crankback cause codes are not included in this specification.

6.2 Crankback cause

In case of call clearing, a Cause information element is mandatory in the first call-clearing message. In case of crankback, a Crankback information element must be included as well as the Cause information element. The Crankback information element must include a crankback cause code, which is used instead of the Cause information element by the preceding node of the AINI interface.
Note that the cause code in the Crankback information element may be updated whenever the crankback is propagated to a preceding node. Specifically, this may be done whenever cranking back beyond a node that received a "succeeding end blocked" crankback but was unable to successfully reroute the call.

6.2.1 Reachability errors

Generally, reachability errors indicate that a path to a destination could not be found. This applies to both transit network and called party destinations. This type of failure indicates that no path exists to the destination. It is different from finding a path that exists but does not satisfy the requested QoS; such failures are discussed in Section 6.2.2 as Resource Errors.
Whenever crankback occurs due to reachability errors, the blocked transit specified in the Crankback information element must be "call or party has been blocked at or beyond the succeeding node".

6.2.1.1   Destination unreachable and transit network unreachable

These cause codes are returned when a node receives a SETUP/ADD PARTY message and there is no connectivity from the node to the called party or transit network. In the case where no reachability information whatsoever exists in the node's routing table for the called party or transit network, the call shall be cleared with cause #2 "no route to specified transit network" or cause #3 "no route to destination".

6.2.2   Resource errors

6.2.2.1   Resource errors due to service category

Crankback can occur due to unsupported service category or bearer class. See sections 6.5.2.3.1/PNNI 1.0 and 6.5.2.7/PNNI 1.0 for further details.

6.2.2.2   Resource errors due to traffic and QoS parameters

The resources needed to support a call are calculated from the traffic parameters and/or QoS parameters included in the SETUP or ADD PARTY message. Resource Errors are used to signal that a path could not be found for the call to satisfy the requested traffic and QoS parameters.
Inability to satisfy the requested traffic and QoS parameters can be detected either during path selection, or during actual CAC. Calls received over an AINI signalling link that are rejected due to insufficient resources are always cranked back.

If the requested user cell rate(s) from the ATM traffic descriptor information element cannot be satisfied, the call will be cranked back with crankback cause #37, "user cell rate not available".

If no path can be found to satisfy the requested maximum CTD, peak-to-peak CDV, and/or CLR (in one and/or the other direction for a call), the call will be cranked back with cause and crankback cause #49, "QoS unavailable".

When blocking due to insufficient resources occurs, it must be determined whether blocking was due to insufficient resources at the succeeding end of the previous link (calls requesting similar resource requirements on other ports might be accepted), insufficient resources at the preceding end of the following link (calls requesting similar resource requirements on other ports might be accepted), or insufficient resources within or beyond the node itself (all calls requesting similar resource requirement from this node are likely to be blocked). Depending on the answer, the procedures in Section 6.3.1.3, 6.3.1.2, or 6.3.1.1, respectively, shall apply.

6.2.2.3   Resource errors due to VPCI/VCI allocation

When the preceding side is unable to allocate a VPCI (for SVPs) or a VPCI/VCI pair (for SVCs), the procedures of Section 6.3.1.2 shall be followed. If no alternate routing is attempted or if alternate routing fails, crankback cause #45 "No VPCI/VCI available" shall be used.

Resource errors due to VPCI/VCI allocation at the succeeding side result in crankback with cause #35 "Requested VPCI/VCI not available" or cause #45 "No VPCI/VCI available", as discussed in Sections 6.5.2.2.1/PNNI 1.0 and 6.5.2.2.2/PNNI 1.0. Whenever VPCI/VCI resource errors occur at the succeeding side of an AINI interface, the blocked transit type in the Crankback information element must be set to "call or party has been blocked at the succeeding end of this interface".

6.3 Procedures for blocked transit

This section describes the procedures used for generating, interpreting, and modifying the blocked transit type. These procedures provide the mechanisms required to manage crankback from the point of blocking, through intermediate nodes, to one or more nodes that are allowed to choose alternate routes for the call.

Pseudocode for the procedures specified in this section is contained in Section 6.3.3. When there is an ambiguity in the narrative text, the pseudocode should be used to resolve the conflict. Where the text and the pseudocode are in disagreement, the text should be used as the prime source.

6.3.1   Procedures at the point of blocking

The procedures carried out at the point of blocking vary depending on whether crankback occurs due to problems at the input port, at the output port, or within the node itself. These procedures are discussed in Section 6.3.1.3, 6.3.1.2, and 6.3.1.1, respectively.

6.3.1.1   Blocking at a node

Upon blocking at a node, crankback procedures are initiated by sending an appropriate call/connection clearing message (RELEASE or RELEASE COMPLETE, or ADD PARTY REJECT) including a Crankback information element. The blocked transit type must be set to "call or party has been blocked at or beyond the succeeding node". The Crankback information element also contains the crankback cause subfield.

6.3.1.2   Blocking at the preceding end of a link

Link blocking can be determined at the preceding end of a link when connection admission control (CAC) within the node at the preceding end of the link determines that insufficient resources are available. If other links exist that can be used to progress the SETUP or ADD PARTY message received by this node, then alternate routing may be attempted.
If no alternate routing is attempted or if alternate routing fails, then the node at the preceding end of the link must crankback the call or party by sending an appropriate clearing message (RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT) including a Crankback information element. The blocked transit type subfield must be set to "call or party has been blocked at or beyond the succeeding node".

6.3.1.3   Blocking at the succeeding end of a link

Link blocking can be determined at the succeeding end of a link when CAC within the node at the succeeding end of the link determines that insufficient resources are available. In this case, the node must crankback the call or party by sending an appropriate clearing message (RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT) including a Crankback information element. The blocked transit type must be set to "call or party has been blocked at the succeeding end of this interface". The Crankback information element also contains the crankback cause subfield.

6.3.2   Receiving a clearing message with a Crankback information element

Upon receiving a clearing message (RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT) including a Crankback information element, a node first checks whether the blocked transit type indicates that the "call or party has been blocked at the succeeding end of this interface". In this case, the procedures of Section 6.3.2.1 must be followed. Otherwise, if the node has alternate links available over which the call can be alternate routed, then the node may forward the call over one of these available interfaces. Note that if the link to be used to retry the call leads to a neighbor that has already been used for this call the re-route attempt is unlikely to succeed. Otherwise, the node must crankback the call or party by sending an appropriate clearing message (RELEASE or ADD PARTY REJECT) including a Crankback information element over its previous interface (towards the calling party).

6.3.2.1   Receiving a clearing message indicating blocking at this interface

When a clearing message (RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT) is received which includes a Crankback information element with blocked transit type indicating "call or party has been blocked at the succeeding end of this interface", the following procedures are carried out. If other links exist that can be used to re-route the call, then alternate routing may be attempted using any of these links. In addition, a SETUP message may only be resent on the blocked link with a different VPCI (for SVPs) or VPCI/VCI pair (for SVCs) if crankback cause #35 "Requested VPCI/VCI not available" is present. Otherwise, if no such other links are available, then the node is

to treat the crankback as though the succeeding node has blocked the call and the procedures of Section 6.3.1.1 shall apply.

If no alternate routing is attempted or if alternate routing fails, then the node must continue to crankback the call or party. The blocked transit type subfield must be changed to indicate "call or party has been blocked at or beyond the succeeding node". After this change to Crankback information element has been made, the node shall send an appropriate clearing message (RELEASE or ADD PARTY REJECT) over its previous interface (towards the calling party).

6.3.3   Pseudocode for Crankback procedures

The operations required when blocking is detected at a node:
1)   Blocking was due to insufficient resources at the:
   a.   whole node:
        call or party clearing message is returned including:
        blocked transit type = call or party has been blocked at or beyond the succeeding node
   b.   preceding end of the following link:
        are other links available to use for alternate routing?
        b.1 yes: may try alternate links.
        b.2 no: call clearing message is returned including:
              blocked transit type = call or party has been blocked at or beyond the succeeding node
   c.   succeeding end of the previous link:
        call or party clearing message is returned including:
        blocked transit type = call or party blocked at succeeding end of interface.

The operations required when receiving a clearing message with a Crankback information element:
2)   does blocked transit type = call or party blocked at succeeding end of interface?
   a.   yes: is crankback cause "requested VPCI/VCI not available"?
        a.1 yes: retry SETUP on same link using different VPCI/VCI values
        a.2 no: are other links available to use for alternate routing?
              a.2.1   yes: try alternate links.
              a.2.2   no:
                   call clearing message is returned including:
                   blocked transit type = call or party has been blocked at or beyond the succeeding node

   b.   no: Is there an alternate link available for this call?
        b.1 yes: send SETUP or ADD PARTY on new path
        b.2 no:
             crankback to previous interface
             blocked transit type = call or party has been blocked at or beyond the succeeding node