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SERIES Q: SWITCHING AND SIGNALLING

Broadband ISDN – B-ISDN application protocols for access signalling

Digital Subscriber Signalling System No. 2: Basic Look-Ahead

ITU-T Recommendation Q.2964.1

(Previously CCITT Recommendation)

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

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ITU-T RECOMMENDATION Q.2964.1

DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 2: BASIC LOOK-AHEAD

Summary

This Recommendation defines the operation of the Digital Subscriber Signalling System No. 2 (DSS 2) for the handling of the Look-Ahead feature that may be supported, as a network option, prior to Basic call and connection control at the T_B or at the coincident S_B and T_B reference point of the User to Network Interface of the Broadband Integrated Services Digital Network (B-ISDN). The Look-Ahead feature defined in this Recommendation enables the network to check whether compatible user equipment are connected to a user-network interface and whether they are free or busy. This feature can be used prior to an incoming call offering at the user-network interface.

FOREWORD

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NOTE

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CONTENTS

Recommendation Q.2964.1

DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 2: BASIC LOOK-AHEAD

(Geneva, 1996)

1.1   Scope

This Recommendation specifies the basic look-ahead protocol for the Broadband Integrated Services Digital Network (B-ISDN) at the T_B reference point or coincident S_B and T_B reference point (as defined in Recommendation I.413 [1]) for the Digital Subscriber Signalling System No. 2 (DSS 2) protocol.

This Recommendation does not specify the additional protocol requirements where the feature is provided to the user via a telecommunications network that is not a B-ISDN.

The basic look-ahead protocol allows provision of look-ahead between the incoming side of a network and the outgoing side of the same network. Decisions on whether to use basic look-ahead protocol are made at each incoming gateway exchange. A mechanism exists between networks (e.g. at the T_B reference point) to allow one network to indicate to another network that basic look-ahead is required.

This Recommendation is applicable to equipments, supporting the look-ahead feature, to be attached at either side of a T_B reference point or coincident S_B and T_B reference point when used as an access to the public B-ISDN.

1.2   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent addition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1]   ITU-T Recommendation I.413 (1993), *B-ISDN user-network interface*.

[2]   ITU-T Recommendation Q.2932.1 (1996), *Digital Subscriber Siganalling System No. 2 (DSS 2) – Generic functional protocol: Core functions*.

[3]   CCITT Recommendation X.219 (1988), *Remote operations – Model, notation and service definition*.

[4]   CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1)*.

[5]   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*.

[6]   ITU-T Recommendation Z.100 (1993), *CCITT Specification and description language (SDL)*.

[7]   ITU-T Recommendation Q.2961.1 (1995), *Additional signalling capabilities to support traffic parameters for the tagging option and the sustainable cell rate parameter set*.

[8]   ITU-T Recommendation Q.2724.1 (1996), *B-ISDN User Part – Look-ahead without state change for the Network Node Interface*.

1.3 Definitions

This Recommendation defines the following terms:

1.3.1   invoke component: See Recommendation Q.2932.1 [2], for the application of this component as defined in Recommendation X.219 [3]. Where reference is made to "xxxx" invoke component, an invoke component is meant with its operation value set to the value of the operation "xxxx".

1.3.2   network: The DSS 2 protocol entity at the network side of the user-network interface.

1.3.3   reject component: See Recommendation Q.2932.1 [2], for the application of this component as defined in Recommendation X.219 [3].

1.3.4   return error component: See Recommendation Q.2932.1 [2], for the application of this component as defined in Recommendation X.219 [3]. Where reference is made to "xxxx" return error component, a return error component is meant which is related to an "xxxx" invoke component.

1.3.5   return result component: See Recommendation Q.2932.1 [2], for the application of this component as defined in Recommendation X.219 [3]. Where reference is made to "xxxx" return result component, a return result component is meant which is related to an "xxxx" invoke component.

1.3.6   user: The DSS 2 protocol entity at the user side of the user-network interface.

1.3.7   availability check: Procedure to check whether the indicated capabilities are available at that moment.

1.3.8   compatibility information: Information according to Recommendation Q.2931 [5].

1.3.9   compatibility check: Procedure according to Recommendation Q.2931 [5].

1.4 Abbreviations

This Recommendation uses the following abbreviations.

ASN.1   Abstract Syntax Notation One

B-ISDN   Broadband Integrated Services Digital Network

CS-2   Capability Set 2

DSS 2   Digital Subscriber Signalling System No. 2

FIE   Facility Information Element

ISDN   Integrated Services Digital Network

NNI   Network-Network Interface

OLEX   Originating Local Exchange

PDU   Protocol Data Unit

ROSE   Remote Operations Service Element

SAAL   Signalling ATM Adaptation Layer

TLEX   Terminating Local Exchange

UNI   User-Network Interface

1.5 Description

The look-ahead procedure allows a public or a private network to check whether compatible and incompatible terminal(s) are addressed and whether these terminal(s) are free or busy. This procedure can be used prior to the establishment of a call/connection.

Clauses 1.9 and 1.10 specify the generic portion of the procedure only. How a feature or an application makes use of the information obtained using these procedures has to be specified in the relevant Recommendations referring to 1.9 and 1.10.

1.6 Operational requirements

1.6.1 Provision and withdrawal

It is a user and a network option to provide the procedures described in this Recommendation.

1.6.2 Requirements on the originating network side

Not applicable for the coincident S_B and T_B reference point. See 1.6.1 for the T_B reference point.

1.6.3 Requirements on the destination network side

See 1.6.1.

1.7 Primitive definitions and state definitions

1.7.1 Primitive definitions

The following primitives are used:
- LOOK_AHEAD.request
- LOOK_AHEAD.indication
- LOOK_AHEAD.response
- LOOK_AHEAD.confirm
- ERROR.indication
- AAL_ESTABLISH.indication
- AAL_RELEASE.indication

1.7.2 State definitions

The state definition is for the purpose of the SDL diagrams, which are included in 1.13.

1.7.2.1 Look-ahead states at the coincident S_B and T_B reference point

1.7.2.1.1 Look-ahead states at the network side of the interface

1.7.2.1.1.1 idle: Idle state.

1.7.2.1.1.2 look-ahead initiated: This state exists when the network has sent a look-ahead invoke component to the addressed user and has not yet received a response.

1.7.2.1.2 Look-ahead states at the user side of the interface

Idle: Idle state.

1.7.2.2 Look-ahead states at the T_B reference point

1.7.2.2.1 Look-ahead states at the outgoing side of the interface

1.7.2.2.1.1 idle: Idle state.

1.7.2.2.1.2 look-ahead invoked: This state exists when an entity has sent a look-ahead invoke component and has not yet received a response.

1.7.2.2.2 Look-ahead states at the incoming side of the interface

1.7.2.2.2.1 idle: Idle state.

1.7.2.2.2.2 look-ahead invoked: This state exists when an entity has received a look-ahead invoke component and has not yet sent a response.

1.8 Coding requirements

1.8.1 Operations and errors

Table 1 contains the definition of the operations and types necessary for the look-ahead procedure using ASN.1 as defined in Recommendation X.208 [4] and using the OPERATION macro as defined in Figure 4/X.219 [3].

The formal definition of the component types to encode these operations and types is provided in Table A.1/Q.2932.1 [2].

The inclusion of components in facility information elements is defined in Table 1 7.2.2.1/Q.2932.1 [2].

Table 1/Q.2964.1 – Look-ahead operations and errors

```
Look-Ahead-Procedure {ccitt recommendation q 2964 operations-and-errors (1)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

EXPORTS          LookAhead, LookAheadTb;

IMPORTS          OPERATION, ERROR

                 FROM Remote-Operation-Notation
                      {joint-iso-ccitt remote-operations(4) notation(0)}

                 DSS2InformationElement
                 FROM Embedded-DSS2-Types
                      {ccitt recommendation q 2932 embedded-dSS2types(7)}

                 Address
                 FROM Addressing-Data-Elements
                      {ccitt recommendation q 932 addressing-data-elements(7)}

                 CauseIndicators
                 FROM LookAheadParameters
                      {ccitt recommendation q 2724 1 modules(0) parameters(2) version1(0)}
```

	System Failure, TaskRefused FROM IN-CS-1-Errors {ccitt recommendation q 1218 modules(0) cs-1-errors(0) version1(0)}

LookAhead	::= OPERATION
	    ARGUMENT DSS2InformationElement
	    -- The following information elements
	    -- shall be embedded in DSS2InformationElement:
	    -- AAL parameters optional
	    -- ATM traffic descriptor
	    -- Broadband bearer capability
	    -- Broadband high layer information optional
	    -- Broadband low layer information optional
	    -- OAM traffic descriptor optional
	    -- QOS parameter
	    -- Narrow-band bearer capability optional
	    -- Narrow-band high layer compatibility optional
	    -- Narrow-band low layer compatibility optional
	    -- The B-LLI, N-BC and N-LLI information elements may be repeated
	    RESULT LookResult

LookAhead	LookAhead ::= localValue 501

LookResult	::= ENUMERATED {
	    compatibleAndFree (0),
	    compatibleAndBusy (1),
	    incompatible (2)}

LookAheadTb	::= OPERATION
	    ARGUMENT SET {
	        Address,
	        DSS2InformationElement
	    -- The following information elements
	    -- shall be embedded in DSS2InfoElement:
	    -- AAL parameters optional
	    -- ATM traffic descriptor
	    -- Broadband bearer capability
	    -- Broadband high layer information optional
	    -- Broadband low layer information optional
	    -- OAM traffic descriptor optional
	    -- QOS parameter
	    -- Narrow-band bearer capability optional
	    -- Narrow-band high layer compatibility optional
	    -- Narrow-band low layer compatibility optional
	    -- The B-LLI, N-BC and N-LLI information elements may be repeated }
	
	    RESULT SET {
	        LookResult,
	        CauseIndicators }
	    ERRORS SET {
	        SystemFailure,
	        TaskRefused }

LookAheadTb	LookAheadTb ::= localValue 502
END -- *Look-Ahead-Procedure*	

All components (invoke, return result, return error and reject) shall be included within a facility information element. The facility information element shall be included in the message as specified in 1.9 and in 1.10.

1.8.2 Coding rules

Within the scope of this Recommendation the coding rules defined in clause 4/Q.2931 [5] apply.

1.9 Signalling procedures at the coincident S_B and T_B reference point

1.9.1 Normal operation

The look-ahead procedure is based on the LookAhead operation. The formal definition of this operation is given in 1.8.1, Table 1. The look-ahead procedure shall make use of the connectionless bearer independent procedures described in 9.1.4/ Q.2932.1 [2].

To start the look-ahead procedure, the network shall perform the following actions:

a)   Send a LookAhead invoke component to the user following the procedures of 9.4.2.1/Q.2932.1 [2] in order to request the operation.

The LookAhead invoke component shall contain the following information elements:

- ATM traffic descriptor;
- broadband bearer capability;
- QOS parameter.

In addition, the LookAhead invoke component may optionally contain the following information elements for which the procedure is required:

- AAL parameters;
- broadband high layer information;
- broadband low layer information;
- narrow-band bearer capability;
- narrow-band high layer compatibility;
- narrow-band low layer compatibility;
- OAM traffic descriptor.

The broadband low layer information, narrow-band bearer capability and narrow-band low layer compatibility information elements may be repeated if the related negotiation procedures defined in Recommendation Q.2931 [5] are used.

b)   Start timer T-LA.

c)   Enter the Look-ahead initiated state.

On receipt of a LookAhead invoke component the user shall provide compatibility checking on the indicated information elements as defined in B.3.2/Q.2931 and B.3.3/Q.2931 [5].

If the LookAhead invoke component contains more than one broadband low layer information element, the user shall perform the compatibility checking for each information element. The user shall be compatible if it is compatible with at least one of them.

If the LookAhead invoke component contains more than one narrow-band low layer compatibility information element, the user shall perform the compatibility checking for each information element. The user shall be compatible if it is compatible with at least one of them.

If the invoke component contains more than one narrow-band bearer capability information element, then the user shall provide compatibility checking for each basic service as indicated by all valid

combinations of narrow-band bearer capability and narrow-band high layer compatibility information element. The user shall be compatible if it is compatible with at least one of them.

The user shall send a LookAhead return result component containing a LookResult parameter to the network according to the procedures of 9.4.2.2/Q.2932.1. The LookResult parameter shall indicate:

• "compatibleAndFree", if the user is free to accept a call for the indicated parameters;

• "compatibleAndBusy", if the user is compatible with the indicated parameters, and the user is not free to accept a call for the indicated parameters;

• "incompatible", if the user is not compatible with at least one of the indicated parameters.

Whilst in the Look-ahead initiated state, the network shall:

a) on receipt of a LookAhead return result component:

   • note the result;

   • stop timer T-LA, enter the Idle state, and terminate the look-ahead procedure.

b) on expiry of timer T-LA:

   • enter the Idle state and terminate the look-ahead procedure.

On termination of the look-ahead procedure, the network will have determined that:

• if a "compatibleAndFree" result has been received, then the terminal is compatible and free;

• if a "compatibleAndBusy" result has been received, then the terminal is compatible and busy;

• if an "incompatible" result has been received, then the terminal is incompatible;

• if no result has been received, then the terminal does not support the look-ahead procedure and its compatibility and free/busy status is unknown.

1.9.2   Exceptional procedures

Whilst in the Look-ahead initiated state and a reject component is received, with an invoke identifier, the network shall stop timer T-LA, enter the Idle state and terminate the look-ahead procedure.

On termination of the look-ahead procedure by receiving a reject component, the network will have determined that:

• the terminal does not support the look-ahead procedure.

If an entity receives an AAL-RELEASE-INDICATION primitive in the Look-Ahead initiated state, then the entity shall abort the look-ahead without informing the other entity, and enter the Idle state.

If an entity receives an AAL-ESTABLISH-INDICATION primitive in the Look-Ahead initiated state, then the entity shall ignore the indication and remain in the current state.

1.10   Procedures for interworking with private B-ISDNs

The look-ahead procedure is based on the LookAheadTb operation. The formal definition of this operation is given in 1.8.1, Table 1. The look-ahead procedure shall make use of the connectionless bearer independent procedures described in 9.1.4/Q.2932.1 [2].

1.10.1   Originating interface

1.10.1.1   Normal operation

To start the look-ahead procedure, the private network shall perform the following actions:

a) send a LookAheadTb invoke component to the public network following the procedures of 9.4.2.1/Q.2932.1 [2] in order to request the operation;

b)   start timer T-LATb;

c)   enter the Look-Ahead invoked state.

On receipt of a LookAheadTb invoke component, the public network shall:

a)   forward the invocation towards the addressed user;

b)   enter the Look-Ahead invoked state.

On receipt of the answer from the addressed user, the public network shall:

a)   send a LookAheadTb return result component or a LookAheadTb return error component to the private network according to the procedures of 9.4.2.2/Q.2932.1;

b)   enter the Idle state and terminate the look-ahead procedure.

Whilst in the Look-Ahead invoked state, the private network shall:

a)   on receipt of a LookAheadTb return result component or of a LookAheadTb return error component:

  •   forward the result to the application;

  •   stop timer T-LATb, enter the Idle state, and terminate the look-ahead procedure;

b)   on expiry of timer T-LATb:

  •   enter the Idle state and terminate the look-ahead procedure.

1.10.1.2   Exceptional procedures

Whilst in the Look-Ahead invoked state and a reject component is received, with an invoke identifier, the private network shall stop timer T-LATb, enter the Idle state and terminate the look-ahead procedure.

If an entity receives an AAL-RELEASE-INDICATION primitive in the Look-Ahead invoked state, then the entity shall abort the look-ahead without informing the other entity, and enter the Idle state.

If an entity receives an AAL-ESTABLISH-INDICATION primitive in the Look-Ahead invoked state, then the entity shall ignore the indication and remain in the current state.

1.10.2   Destination interface

1.10.2.1   Normal operation

To start the look-ahead procedure, the public network shall perform the following actions:

a)   send a LookAheadTb invoke component to the private network following the procedures of 9.4.2.1/Q.2932.1 [2] in order to request the operation;

b)   start timer T-LATb;

c)   enter the Look-Ahead invoked state.

On receipt of a LookAheadTb invoke component, the private network shall:

a)   forward the invocation towards the addressed user;

b)   enter the Look-Ahead invoked state.

On receipt of the answer from the addressed user, the private network shall:

a)   send a LookAheadTb return result component or a LookAheadTb return error component to the public network according to the procedures of 9.4.2.2/Q.2932.1;

b)   enter the Idle state and terminate the look-ahead procedure.

Whilst in the Look-Ahead invoked state, the public network shall:

a)   on receipt of a LookAheadTb return result component or of a LookAheadTb return error component:

  •   forward the result;

  •   stop timer T-LATb, enter the Idle state, and terminate the look-ahead procedure;

b)   on expiry of T-LATb:

  •   enter the Idle state and terminate the look-ahead procedure.

1.10.2.2   Exceptional procedures

Whilst in the Look-Ahead invoked state and a reject component is received, with an invoke identifier, the public network shall stop timer T-LATb, enter the Idle state and terminate the look-ahead procedure.

On termination of the look-ahead procedure by receiving a reject component, the public network will have determined that:

  •   the private network does not support the look-ahead procedure.

If an entity receives an AAL-RELEASE-INDICATION primitive in the Look-Ahead invoked state, then the entity shall abort the look-ahead without informing the other entity, and enter the Idle state.

If an entity receives an AAL-ESTABLISH-INDICATION primitive in the Look-Ahead invoked state, then the entity shall ignore the indication and remain in the current state.

1.11   Interactions with other networks

1.11.1   Interworking with N-ISDNs

Interworking with N-ISDNs is outside the scope of this Recommendation.

1.11.2   Interworking with non-ISDNs

Interworking is precluded by Recommendation Q.2932.1 [2].

1.11.3   Interworking with frame relay

Interworking is precluded by Recommendation Q.2932.1 [2].

1.11.4   Interworking with PSPDNs

Interworking is precluded by Recommendation Q.2932.1 [2].

1.12   Parameter values (timers)

1.12.1   Timer at the coincident S_B and T_B reference point

Table 2 shows the timer used for the look-ahead procedure at the coincident S_B and T_B reference point.

Table 2/Q.2964.1 – Timer in the network side

Timer value	Time out value	Cause for start	Normal stop	At expiry
T-LA	The time out value is application dependent	LookAhead invoke component sent	LookAhead return result component received	Return to Idle

1.12.2 Timer at the T_B reference point

Table 3 shows the timer used for the look-ahead procedure at the T_B reference point.

<p align="center">Table 3/Q.2964.1 – Timer in the network and user side</p>

Timer value	Time out value	Cause for start	Normal stop	At expiry
T-LATb	The time out value is application dependent	LookAheadTb invoke component sent	LookAheadTb return result component received	Return to Idle

1.13 Dynamic description (SDLs)

This clause contains the SDL description for the look-ahead procedure for the user and the network.

The description consists of the following figures specified according to Recommendation Z.100 [6]:

Figure 1:   User SDL diagrams at the coincident S_B and T_B reference point.

Figure 2:   Network SDL diagrams at the coincident S_B and T_B reference point.

Figure 3:   User and network SDL diagrams at the T_B reference point.

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<p align="center">Figure 1/Q.2964.1 – Look-ahead procedure: User SDL diagrams at the
coincident S_B and T_B reference point</p>

```
                            ┌──────────────┐
                            │     Idle     │
                            └──────┬───────┘
                                   │
                            ┌──────┴───────┐
                            │ LOOK-AHEAD   │
                            │ request      │
                            └──────┬───────┘
                                   │
                            ┌──────┴───────┐
                            │    SET       │
                            │(NOW+LOOKAHEAD,│
                            │    T-LA)     │
                            └──────┬───────┘
                                   │
                            ┌──────┴────────┐
                            │ FACILITY      │
                            │(LookAhead invoke)│
                            └──────┬────────┘
                                   │
                            ┌──────┴───────┐
                            │  Look-Ahead  │
                            │  Initiated   │
                            └──────────────┘
```
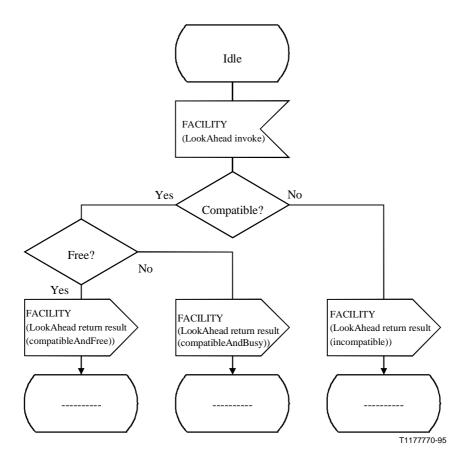
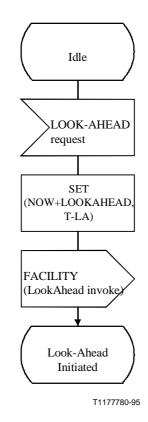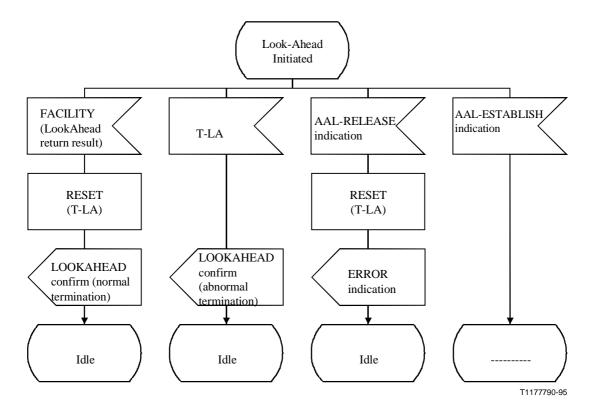T1177780-95

T1177790-95

Figure 2/Q.2964.1– Look-ahead procedure: Network SDL diagrams at the coincident S_B and T_B reference point
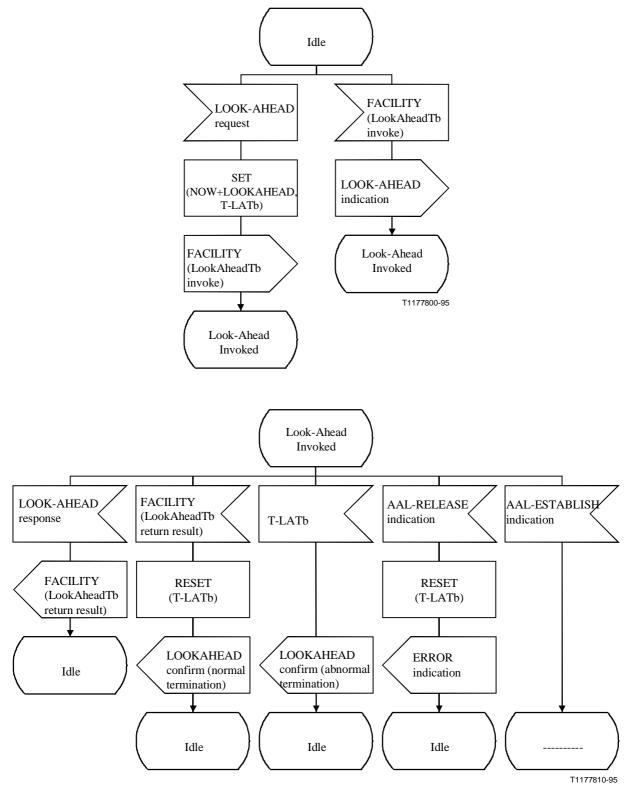
Figure 3/Q.2964.1 – Look-ahead procedure: User and network SDL diagrams at the T_B reference point

ANNEX A

Network look-ahead indication

A.1   Scope

This Annex provides the definition of a new information element to be included in the SETUP message at the T_B reference point in order to indicate during the call/connection establishment that a network look-ahead was performed for that specific call.

A.2   Coding requirements

A.2.1   Messages

Table A.1 lists the existing Q.2931 messages that are modified to support the procedure described in this Annex.

Table A.1/Q.2964.1 – Modified Q.2931 messages

Message	Reference
SETUP	A.2.1.1

A.2.1.1   SETUP

This message is sent by the calling user to the network and by the network to the called user to initiate B-ISDN call and connection establishment. See Table A.2 for additions to the structure of this message for the T_B reference point.

Table A.2/Q.2964.1 – SETUP message additional content

Message type:	SETUP			
Significance:	Global			
Direction:	Both			
Information element	**Reference**	**Direction**	**Type**	**Length**
Network look-ahead indicator	A.2.2.1	Both	O	4 - 5

A.2.2   Information elements

A.2.2.1   Network look-ahead indicator

The purpose of the network look-ahead indicator information element is to indicate during the call and connection establishment phase that a network look-ahead was performed for that specific call and connection request.

The network look-ahead indicator information element can be included in the SETUP message at the T_B reference point.

Figure A.1 shows the structure of the network look-ahead indicator information element. Table A.3 shows the values of the network look-ahead indication field.

8	7	6	5	4	3	2	1	Octets
Bits								
1	0	0	0	0	0	1	1	1
Network look-ahead indicator information element identifier								
1 ext.	Coding standard		Information element instruction field					2
			Flag	Reserved	Action indicator			
Length of network look-ahead indicator contents								3
								4
1 ext.	Spare					Look-ahead indicator		5

Figure A.1/Q.2964.1 – Network look-ahead indicator information element

Table A.3/Q.2964.1 – Network look-ahead indicator information element

– Look-ahead indicator (octet 5)
Bits
2   1
0   0   no indication
0   1   network look-ahead invoked – no indication
1   0   reserved
1   1   network look-ahead invoked – an answer received from the terminating exchange or private network

A.3 Signalling procedures at the T_B reference point

A.3.1 Normal operations

A.3.1.1 Setting the network Look-Ahead indicator

If an entity has invoked a look-ahead procedure, in the SETUP message that may follow, that entity may include the network look-ahead indicator information element. The network look-ahead indicator information element shall be set to:

• "network look-ahead invoked – an answer received from the terminating exchange or private network" if an answer has been received from the terminating exchange or private network;

• "network look-ahead invoked – no indication" if an answer has not been received from the terminating exchange or private network; in this case an answer might have been received from an intermediate exchange or private network or no answer might have been received.

A.3.1.2 Receiving the network Look-Ahead indicator

Upon receiving a SETUP message including the network look-ahead indicator information element, an entity will determine that the look-ahead procedure was invoked before call/connection establishment.

The entity shall decide according to its own logic either to invoke the look-ahead procedure or to proceed with the call/connection establishment.

A.3.2 Error handling procedures

See 5.8/Q.2931.

NOTE – The action indicator field of the network look-ahead indicator information element should be coded as "Discard information element and proceed".

APPENDIX I

Information flows

This Appendix shows examples of the application of the look-ahead procedure. The relation with the User A side is indicated only for information. See Figures I.1 and I.2.
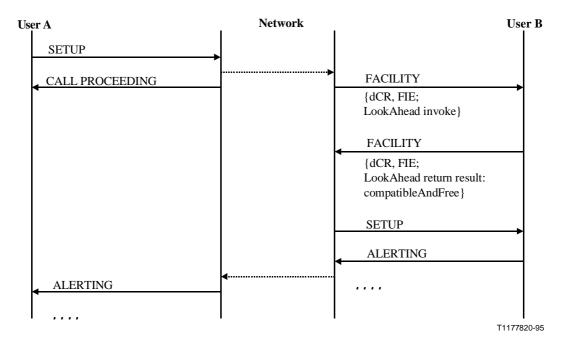

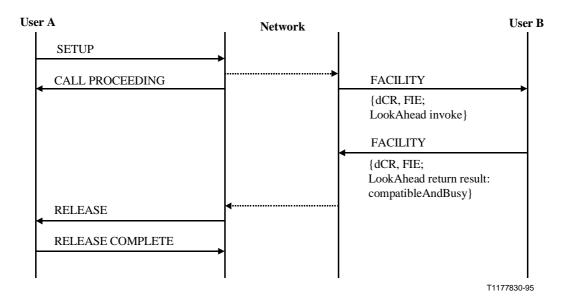**Figure I.1/Q.2964.1 – Look-ahead: positive answer**

Figure I.2/Q.2964.1 – Look-ahead: negative answer

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