



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**Q.2965.2**

(12/1999)

SERIES Q: SWITCHING AND SIGNALLING

Broadband ISDN – B-ISDN application protocols for  
access signalling

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**Digital subscriber signalling system No. 2 –  
Signalling of individual Quality of Service  
parameters**

ITU-T Recommendation Q.2965.2

(Formerly CCITT Recommendation)

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*For further details, please refer to the list of ITU-T Recommendations.*

## **ITU-T Recommendation Q.2965.2**

### **Digital subscriber signalling system No. 2 – Signalling of individual Quality of Service parameters**

#### **Summary**

This ITU-T Recommendation is part of the DSS2 family of ITU-T Recommendations.

The purpose of this ITU-T Recommendation is to describe the DSS2 messages, information elements, and procedure modifications needed to support the signalling of individual QoS parameters as described in ITU-T Recommendation I.356 (2000) to ensure smooth QoS interworking with private networks.

#### **Source**

ITU-T Recommendation Q.2965.2 was prepared by ITU-T Study Group 11 (1997-2000) and approved under the WTSC Resolution 1 procedure on 3 December 1999.

## FOREWORD

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In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

## NOTE

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## ITU-T Recommendation Q.2965.2

### Digital subscriber signalling system No. 2 – Signalling of individual Quality of Service parameters

(Geneva, 1999)

#### 1 Scope

Recommendation ITU-T Q.2965 covers the support of quality of service indication for the Broadband Integrated Services Digital Network (B-ISDN) at the coincident  $S_B$  and  $T_B$  reference point or at the  $T_B$  reference point as defined in ITU-T Recommendation I.413 [1] by means of the Digital Subscriber Signalling System No. 2 (DSS2). This ITU-T Recommendation defines DSS2 protocol formats and procedures that support the indication of quality of service related capabilities.

This ITU-T Recommendation is part of the DSS2 family of ITU-T Recommendations. It specifies the DSS2 messages, information elements, and procedure modifications needed to support the signalling of individual QoS parameters as described in ITU-T Recommendation I.356 [2] to ensure smooth QoS interworking with private networks.

This part specifies extensions to ITU-T Recommendations Q.2931 [4] and Q.2965.1 [3] in order to enable the optional signalling of individual Quality of Service (QoS) parameters as defined in ITU-T Recommendation I.356 [2].

#### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitutes 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 edition 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 I.356 (2000), *B-ISDN ATM layer cell transfer performance*.
- [3] ITU-T Recommendation Q.2965.1 (1999), *Digital subscriber signalling system No. 2 – Support of Quality of Service classes*.
- [4] ITU-T Recommendation Q.2931 (1995), *Digital subscriber signalling system No. 2 (DSS2) – User network interface (UNI) – Layer 3 specification for basic call/connection control and its Amendments 1, 2, 3 and 4*.
- [5] ITU-T Recommendation Q.2971 (1995), *Digital subscriber signalling systems No. 2 (DSS2) – User-network interface layer 3 specification for point-to-multipoint call/connection control*.
- [6] ITU-T Recommendation I.371 (2000), *Traffic control and congestion control in B-ISDN*.
- [7] ITU-T Recommendation Q.2961.1 (1995), *Digital subscriber signalling system No. 2 – Additional traffic parameters – Additional signalling capabilities to support traffic parameters for the tagging option and the sustainable cell rate parameter set*.

- [8] ITU-T Recommendation Q.2961.2 (1997), *Digital subscriber signalling system No. 2 – Additional traffic parameters – Support of ATM transfer capability in the broadband bearer capability information element.*
- [9] ITU-T Recommendation Q.2961.3 (1997), *Digital subscriber signalling system No. 2 – Additional traffic parameters – Signalling capabilities to support traffic parameters for the available bit rate (ABR) ATM transfer capability.*
- [10] ITU-T Recommendation Q.2961.4 (1997), *Digital subscriber signalling system No. 2 – Additional traffic parameters – Signalling capabilities to support traffic parameters for the ATM Block Transfer (ABT) ATM transfer capability.*
- [11] ITU-T Recommendation Q.2961.6 (1998), *Digital subscriber signalling system No. 2 – Additional traffic parameters – Additional signalling procedures for the support of the SBR2 and SBR3 ATM transfer capabilities.*
- [12] ITU-T Recommendation Q.2934 (1998), *Digital subscriber signalling system No. 2 – Switched virtual path capability.*
- [13] ITU-T Recommendation Q.2951 (1995), *Stage 3 description for number identification supplementary services using B-ISDN digital subscriber signalling system No. 2 (DSS2) – Basic call.*
- [14] ITU-T Recommendation Q.2957.1 (1995), *Stage 3 description for additional information transfer supplementary services using B-ISDN digital subscriber signalling system No. 2 (DSS2) – Basic call: User-to-User signalling (UUS).*
- [15] ITU-T Recommendation Q.2955.1 (1997), *Stage 3 description for community of interest supplementary services using B-ISDN digital subscriber signalling system No. 2: Closed user group (CUG).*
- [16] ITU-T Recommendation Q.2962 (1998), *Digital subscriber signalling system No. 2 – Connection characteristics negotiation during call/connection establishment phase.*
- [17] ITU-T Recommendation Q.2963.1 (1999), *Digital subscriber signalling system No. 2 – Connection modification: Peak cell rate modification by the connection owner.*
- [18] ITU-T Recommendation Q.2963.2 (1997), *Digital subscriber signalling system No. 2 – Connection modification: Modification procedures for sustainable cell rate parameters.*
- [19] ITU-T Recommendation Q.2963.3 (1998), *Digital subscriber signalling system No. 2 – Connection modification: ATM traffic descriptor modification with negotiation by the connection owner.*
- [20] ITU-T Recommendation Q.2764 (1999), *Broadband integrated services digital network (B-ISDN) – Signalling system No. 7 B-ISDN user part (B-ISUP) – Basic call procedures.*

### **3 Definitions**

The definitions of ITU-T Recommendations Annex J/Q.2931 [4] and Q.2965.1 [3] apply. In addition, the definitions of QoS parameters as defined in ITU-T Recommendation I.356 [2] apply. In the following text of this ITU-T Recommendation the term "individual QoS parameters" includes the QoS parameters cell delay variation and cell loss ratio according to ITU-T Recommendation I.356 [2], while the term "end-to-end transit delay" includes the QoS parameter cell transfer delay according to ITU-T Recommendation I.356 [2].



## **4 Abbreviations**

The abbreviations of ITU-T Recommendations Annex J/Q.2931 [4] and Q.2965.1 [3] apply. For the purpose of this ITU-T Recommendation, the following abbreviations apply in addition:

CDV Cell Delay Variation

CLR Cell Loss Ratio

CTD Cell Transfer Delay

## **5 Description**

This part specifies extension to ITU-T Recommendation Q.2965.1 [3] in order to enable the optional signalling of Quality of Service (QoS) parameters as defined in ITU-T Recommendation I.356 [2].

While establishing a new ATM connection (VP or VC), the calling user at the  $T_B$  reference point can optionally signal the individual QoS parameters CDV and CLR in addition to the mandatory signalling of the QoS class as per ITU-T Recommendation Q.2965.1 [3]. For the end-to-end transit delay procedures, extensions to ITU-T Recommendation Q.2931 [4] are provided in order to allow the signalling of the origin of the generation of the end-to-end transit delay values.

The signalling of these QoS parameters is predicated upon the signalled QoS class (see Annex A).

## **6 Operation requirements**

### **6.1 Provision and withdrawal**

Signalling of the End-to-transit delay information element is available as part of the basic call (see ITU-T Recommendation Q.2931 [4]). The user may signal individual QoS parameters at the  $T_B$  reference point as specified in this ITU-T Recommendation without any prior arrangement with the service provider. Signalling of the Extended QoS parameters information element shall be restricted to the  $T_B$  reference point.

### **6.2 Requirements at the originating network side**

See subclause 6.1/Q.2965.2.

### **6.3 Requirements at the terminating network side**

See subclause 6.1/Q.2965.2.

## **7 Primitives**

No new primitives are required to support this capability.

## **8 Coding requirements**

This clause specifies additions and modifications to the Q.2931 messages and information elements in order to support signalling of QoS parameters in addition to the signalling of the QoS class as described in ITU-T Recommendation Q.2965.1 [3].

## 8.1 Modified message contents

### 8.1.1 CONNECT

This message is sent by the called user to the network and by the network to the calling user to indicate call acceptance by the called user. See Table 8-1 below for additions and modifications to the structure of this message from that shown in Tables 3-4/Q.2931 [4], 3-15/Q.2931 [4] and 8-4/Q.2971 [5].

**Table 8-1/Q.2965.2 – CONNECT Message Additional Contents**

Message Type: CONNECT

Significance: Global

Direction: Both

Information Element	Reference	Direction	Type	Length
Extended QoS parameters	8.2.2	Both	O (Note)	4-13
NOTE – May be included in the user-to-network direction at the T <sub>B</sub> reference point when the called user received this information element in the SETUP message and the origin of the information element was the calling user. Shall be included in the network-to-user direction at the T <sub>B</sub> reference point if the network received this information element in the connect indication. The origin sub-field (octet 5) in the Extended QoS parameters information element is not significant in the CONNECT message.				

### 8.1.2 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 8-2 below for additions to the structure of this message from that shown in Tables 3-8/Q.2931 [4], 3-19/Q.2931 [4] and 8-5/Q.2971 [5].

**Table 8-2/Q.2965.2 – SETUP Message Additional Contents**

Message Type: SETUP

Significance: Global

Direction: Both

Information Element	Reference	Direction	Type	Length
Extended QoS parameters	8.2.2	Both	O (Note)	4-25
NOTE – Included at the T <sub>B</sub> reference point to specify individual QoS parameter requirements for the call.				

## 8.2 Information elements

### 8.2.1 End-to-end transit delay

The purpose of the End-to-end transit delay information element is to indicate the nominal maximum end-to-end transit delay acceptable on a per-call basis, and to indicate the cumulative transit delay to be expected for a virtual channel connection.

Transit delay is the end-to-end one-way transit delay of user data transferred during the data transfer phase on the user plane, between the calling user and the called user. It includes (see B.1/I.356[2]):

- the total processing time in the end user systems (e.g. processing time, AAL handling delay, ATM cell assembly delay, and possibly any additional processing delay); and
- the cell transfer delay (CTD) as defined in ITU-T Recommendation I.356 [2] (e.g. propagation delay, ATM layer transfer delay, possibly any additional processing delay in the network).

The cumulative transit delay value indicated by the calling user in the SETUP message (if present) includes the cumulative transit delay from the calling user to the network boundary.

The cumulative transit delay value indicated by the network in the SETUP message sent to the called user is the sum of the value which was indicated at the originating UNI and the expected transfer delay accumulated within the network. It does not include further transfer delay on the way from the network boundary to the called user.

The cumulative transit delay value which is transferred over both UNIs in the CONNECT message is the expected total end-to-end transit delay value for user data transfer over the related virtual channel connection as provided for a given call.

The maximum end-to-end transit delay value may be indicated by the calling user to specify end-to-end transit delay requirements for this call. In this case, the maximum end-to-end transit delay includes the end user delay (e.g. AAL handling delay) in addition to the CTD as defined in ITU-T Recommendation I.356 [2]. This field is included by the network in the SETUP message to indicate that the calling user has specified end-to-end transit delay requirements for this call.

The maximum end-to-end transit delay is not included in the CONNECT message.

The end-to-end transit delay is coded as shown in Figure 1 and Table 1.

The maximum length of this information element is 11 octets.

8	7	6	5	4	3	2	1	Octets
End-to-end transit delay information element identifier								
0	1	0	0	0	0	1	0	1
Ext. 1	Coding Standard	Information Element Instruction Field			Information Element Action Ind.			2
		Flag	Res.					
Length of end-to-end transit delay contents								3
Length of end-to-end transit delay contents (continued)								4
0	0	0	0	0	0	0	1	5
Cumulative transit delay identifier								
Cumulative transit delay value								5.1
Cumulative transit delay value (continued)								5.2
0	0	0	0	0	0	1	1	6*
Maximum end-to-end transit delay identifier								
Maximum end-to-end transit delay value								6.1*
Maximum end-to-end transit delay value (continued)								6.2*
0	0	0	0	1	0	1	0	7*
Network generated indicator								(Note)

NOTE – Included at the T<sub>B</sub> reference point if and only if the origin of this information element is other than the calling user within the private network. This sub-field may be present only in a SETUP message at the T<sub>B</sub> reference point.

**Figure 1/Q.2965.2 – End-to-end transit delay information element**

**Table 1/Q.2965.2 – End-to-end transit delay information element**

- Cumulative transit delay value (octets 5.1 and 5.2)  
The cumulative transit delay value is binary encoded in milliseconds. The coding rules for integer values described in 4.5.1 apply.  
The cumulative transit delay value occupies 16 bits total.
- Maximum end-to-end transit delay value (octets 6.1 and 6.2)  
The maximum end-to-end transit delay value is binary encoded in milliseconds. The coding rules for integer values described in 4.5.1 apply.  
The maximum end-to-end transit delay value occupies 16 bits total.  
The value "1111 1111 1111 1111", however, is not to be interpreted as a maximum end-to-end transfer delay value. This codepoint indicates: "any end-to-end transit delay value acceptable; deliver cumulative end-to-end transit delay value to the called user".
- Network-generated indicator (Octet 7)  
The presence of this sub-field indicates the origin of this information element is other than the calling user within the private network.  
If this sub-field is not present, then the origin of this information element is the calling user within the private network (so the called user can assume that the received cumulative values are end-to-end values including the user handling delays in addition to the CTD as defined in ITU-T Recommendation I.356). However, note that this assumption is not fully reliable as there may be implementations according to earlier versions which do not use the network-generated indicator in octet 7 according to this ITU-T Recommendation.

### **8.2.2 Extended QoS parameters**

The purpose of the Extended QoS parameters information element is to indicate individual QoS parameter values acceptable on a per call basis and to indicate the cumulative QoS parameter values.

The relevant QoS parameters applicable to user data transferred during the data transfer phase on the user plane are defined in ITU-T Recommendation I.356 [2].

The Extended QoS parameter information element is coded as shown in Figure 2 and Table 2. The maximum length of this information element is 25 octets.

	8	7	6	5	4	3	2	1	Octets
Extended QoS parameters Information element identifier									
	1	1	1	0	1	1	0	0	1
Ext. 1	Coding Standard		Information Element Instruction Field			Information Element Action Ind.			2 (Note 1)
	0	0	Flag	Res.					
Length of Extended QoS parameters contents									3
Length of Extended QoS parameters contents (continued)									4
Origin									5
	1	0	0	1	0	1	0	0	6*
Acceptable forward 2-point cell delay variation identifier									
Acceptable forward 2-point cell delay variation									6.1*
Acceptable forward 2-point cell delay variation (continued)									6.2*
Acceptable forward 2-point cell delay variation (continued)									6.3*
	1	0	0	1	0	1	0	1	7*
Acceptable backward 2-point cell delay variation identifier									
Acceptable backward 2-point cell delay variation									7.1*
Acceptable backward 2-point cell delay variation (continued)									7.2*
Acceptable backward 2-point cell delay variation (continued)									7.3*
	1	0	0	1	0	1	1	0	8*
Cumulative forward 2-point cell delay variation identifier									(Note 2)
Cumulative forward 2-point cell delay variation									8.1*
Cumulative forward 2-point cell delay variation (continued)									8.2*
Cumulative forward 2-point cell delay variation (continued)									8.3*
	1	0	0	1	0	1	1	1	9*
Cumulative backward 2-point cell delay variation identifier									(Note 2)
Cumulative backward 2-point cell delay variation									9.1*
Cumulative backward 2-point cell delay variation (continued)									9.2*
Cumulative backward 2-point cell delay variation (continued)									9.3*
	1	0	1	0	0	0	1	0	10*
Acceptable forward cell loss ratio identifier									(Note 3)
Acceptable forward cell loss ratio									10.1*
	1	0	1	0	0	0	1	1	11*
Acceptable backward cell loss ratio identifier									(Note 3)
Acceptable backward cell loss ratio									11.1*

NOTE 1 – As a network option, coding standard value "11" may be used.

NOTE 2 – If an acceptable forward and/or backward 2-point CDV is included, then the corresponding cumulative forward and/or backward 2-point CDV shall be included, respectively.

NOTE 3 – The acceptable forward and/or backward cell loss ratio specified is either for the CLP = 0 traffic stream or for the CLP = 0 + 1 traffic stream, depending on the conformance definition (see Annex A).

**Figure 2/Q.2965.2 – Extended QoS parameters information element**

**Table 2/Q.2965.2 – Extended QoS parameters information element**

– Origin (octet 5)	
Indicates the origin of this information element. If the origin is the calling party, then the called party can assume that the received cumulative values are end-to-end values. Otherwise, the received cumulative values do not represent end-to-end values.	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Calling user (Note 1)
0 0 0 0 0 0 0 1	Intermediate network (Note 2)
NOTE 1 – This codepoint is used when the origin of this information element is the calling user within a private network.	
NOTE 2 – This codepoint is used when this information element is generated by a private network at the originating side of a T <sub>B</sub> reference point or by a public network.	
– Acceptable forward/backward 2-point cell delay variation (octets 6.1-6.3/7.1-7.3)	
The acceptable forward and backward 2-point cell delay variation parameters indicate the calling user's highest acceptable (least desired) 2-point cell delay variation values, expressed in units of microseconds. They are coded as 24-bit binary integers, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit. The value "1111 1111 1111 1111 1111 1111", however, is not to be interpreted as an acceptable 2-point cell delay variation value. This code-point or the lack of this identifier in this information element indicates: "any forward/backward 2-point cell delay variation value acceptable".	
– Cumulative forward/backward 2-point cell delay variation (octets 8.1-8.3/9.1-9.3)	
The cumulative forward/backward 2-point cell delay variation values are expressed in units of microseconds. They are coded as 24-bit binary integers, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit.	
– Acceptable forward/backward cell loss ratio (octets 10.1/11.1)	
The acceptable forward and backward cell loss ratio parameters indicate the calling user's highest acceptable (least desired) cell loss ratio values. A cell loss ratio is expressed as an order of magnitude n, where the cell loss ratio takes the value 10 <sup>-n</sup> . The value n is coded as a binary integer, having a range of 1 ≤ n ≤ 15. In addition, the value "1111 1111" or the lack of this identifier in this information element indicates: "any forward/backward cell loss ratio value acceptable". All other values are reserved.	

## 9 Signalling procedures at the coincident S<sub>B</sub> and T<sub>B</sub> reference point

This clause describes the call/connection control procedures to support signalling of end-to-end transit delay at the S<sub>B</sub>/T<sub>B</sub> reference point. These procedures are in addition to the procedures in ITU-T Recommendation Q.2931 as amended by ITU-T Recommendation Q.2965.1 for specifying QoS classes.

### 9.1 Procedures at the originating interface

#### 9.1.1 QoS and traffic parameters selection procedures (originating interface)

The inclusion of the End-to-end transit delay information element in the SETUP message by the calling user is optional.

The possible inclusion of the End-to-end transit delay information element in the SETUP message by the calling user is determined by the combination of the bearer class, broadband transfer capability, ATM traffic parameters and the QoS class of the call according to Annex A.

If the calling user includes an End-to-end transit delay information element in the SETUP message, both the cumulative transit delay subfield and the maximum End-to-end transit delay sub-field shall be present. The user may set the maximum end-to-end transit delay to the value "any end-to-end transit delay value acceptable, deliver cumulative end-to-end transit delay value to the called user", if any end-to-end transit delay is acceptable.

If the network detects that the combination of the End-to-end transit delay information element with the bearer class, Broadband transfer capability, ATM traffic descriptor and QoS parameter information elements is not valid (see Annex A), the network shall return a RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

If the network receives an End-to-end transit delay information element which contains only the maximum end-to-end transit delay subfield or only the cumulative end-to-end transit delay subfield, the network shall handle the End-to-end transit delay information element as a non-mandatory information element with content error.

For the handling of the cumulative transit delay, the rules in Annex B shall apply.

If the network is able to provide the requested end-to-end transit delay value, the network shall progress the call to the called user.

### **9.1.2 Call/Connection acceptance (originating interface)**

The network shall include an End-to-end transit delay information element in the CONNECT message sent to the calling user if the calling user included an End-to-end transit delay information element in the SETUP message. No maximum end-to-end transit delay subfield shall be included.

## **9.2 Procedures at the destination interface**

### **9.2.1 QoS and traffic parameter selection procedures (destination interface)**

The network shall include an End-to-end transit delay information element with the cumulative transit delay sub-field and the maximum end-to-end transit delay subfield in the SETUP message, if both sub-fields were received in the setup indication, and the network generated indicator sub-field was not received in the setup indication. If the network generated indicator sub-field is received in the setup indication, the End-to-end transit delay information element shall not be sent to the called user.

When the called user receives a SETUP message, the called user shall decide whether the requested quality of service can be supported based on the QoS class and on the acceptable maximum end-to-end transit delay (if an End-to-end transit delay information element is included). If the called user is not able to provide the requested quality of service, the user shall reject the call, returning a RELEASE COMPLETE message with Cause #49, "*Quality of service unavailable*".

It is recommended that the called user updates the cumulative transit delay value received from the network to account for the expected increases due to user data transfer from the network boundary to the user (see the rules in Annex B). If the cumulative transit delay value exceeds the maximum end-to-end transit delay value specified by the calling user, it is recommended that the called user rejects the call with Cause #49, "*Quality of service not available*".

If the called user detects that the combination of the End-to-end transit delay information element with the Bearer class, Broadband transfer capability, ATM traffic descriptor and QoS parameter information elements is not valid (see Annex A), the called user shall return a RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

### **9.2.2 Call/Connection acceptance (destination interface)**

If the SETUP message sent to the called user included an End-to-end transit delay information element, the called user may include an End-to-end transit delay information element in the CONNECT message specifying the final cumulative transit delay value for the call. No maximum end-to-end transit delay sub-field shall be included.

If the network receives an End-to-end transit delay information element in the CONNECT message containing a maximum end-to-end transit delay subfield, this subfield shall be discarded. The network does not check the correctness of the cumulative transit delay value provided.

For the handling of the cumulative transit delay, the rules in Annex B shall apply.

## **10 Signalling procedures at the T<sub>B</sub> reference point**

This clause describes the call/connection control procedures to support signalling of individual QoS parameters and end-to-end transit delay at the T<sub>B</sub> reference point. These procedures are in addition to the procedures in ITU-T Recommendation Q.2931 as amended by ITU-T Recommendation Q.2965.1 [3] for specifying QoS classes. If not stated explicitly in this clause, for the handling of the End-to-end transit delay information element, the procedures of clause 9 shall apply.

### **10.1 Procedures at the originating interface**

#### **10.1.1 QoS and Traffic parameters selection procedures (originating interface)**

The possible inclusion of the End-to-end transit delay information element and the Extended QoS parameters information element in the SETUP message by the user is determined by the combination of the bearer class, broadband transfer capability, ATM traffic parameters and the QoS class of the call. The allowed individual QoS parameters are specified in Annex A.

NOTE 1 – If a user at the originating side of a T<sub>B</sub> reference point (i.e. private network) receives a setup indication with no QoS parameter information element but with an Extended QoS parameter information element and/or an End-to-end transit delay information element, the user shall generate if possible, a QoS parameter information element using a local mapping from the received individual QoS parameters in the End-to-end transit delay and/or Extended QoS parameters. If such a mapping is not possible, the call shall be released towards the calling user.

NOTE 2 – If a user at the originating side of a T<sub>B</sub> reference point (i.e. private network) receives a setup indication with no Extended QoS parameters information element, the user may optionally generate an Extended QoS parameter information element and/or an End-to-end transit delay information element (the latter only if none is contained in the setup indication) using a local mapping from the forward and backward QoS class subfields in the QoS parameter information element. When such a mapping is used, the individual QoS parameters for which values are implied (from the QoS classes included in the QoS parameter information element) must be specified, and 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). The QoS parameter information element shall remain in the SETUP message progressed to the network.

For the handling of the cumulative transit delay, the rules in Annex B shall apply.

The cumulative forward 2-point cell delay variation value indicated by the calling customer network, if present, shall include the value from the calling user to the public network, including the link between the calling customer network and the public network. The cumulative backward 2-point cell delay variation value indicated by the calling customer network, if present, shall include the value from the calling user to the public network, but not including the link between the calling customer network and the public network.



When an Extended QoS parameters information element is received in the SETUP message, the network shall not derive values for any absent individual QoS parameters. When an Extended QoS parameters information element is present, if no acceptable forward and/or backward value of an allowed individual QoS parameter for the corresponding combination of the bearer class, Broadband Transfer capability, ATM traffic descriptor and QoS parameter information element is specified (in the Extended QoS parameters or End-to-end transit delay information elements), then any value of the individual QoS parameter is deemed acceptable for this call. If the End-to-end transit delay information element is included in the SETUP message and the Extended QoS parameters information element is not included, then the QoS class included in the QoS parameter information element shall not be used to determine any objectives for maximum end-to-end transit delays for this call/connection but may be used to determine the remaining parameters.

At the originating interface, if the 2-point cell delay variation parameter is received from the calling customer network in the SETUP message, the network shall increment the cumulative backward 2-point cell delay variation value to account for the expected increase due to user data transfer over the link between the calling customer network and the public network. The network shall also increment the cumulative forward and backward 2-point cell delay variation values to account for expected increases due to user data transfer within the originating local exchange.

If the network detects that any cumulative 2-point cell delay variation value exceeds the acceptable 2-point cell delay variation, the network shall reject the call with Cause #49, "*Quality of service unavailable*".

If the network detects that the Extended QoS parameters information element and/or End-to-end transit delay information element contain a non-supported set of individual QoS parameters for the indicated Bearer class, Broadband transfer capability and QoS class of the call (see Annex A), the network shall return a RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

If the network is able to provide the acceptable values of all specified individual QoS parameters, the network shall progress the call to the called user.

### **10.1.2 Call/Connection acceptance (originating interface)**

If the received connect indication includes an Extended QoS parameters information element and/or an End-to-end transit delay information element, then the CONNECT message sent to the user shall include the Extended QoS parameters information element and/or End-to-end transit delay information element, respectively.

## **10.2 Procedures at the destination interface**

### **10.2.1 QoS and Traffic parameter selection procedures (destination interface)**

If the network receives a setup indication with no QoS parameter information element but with an Extended QoS parameter information element and/or an End-to-end transit delay information element, the network shall generate, if possible, a QoS parameter information element using a local mapping from the received individual QoS parameters in the End-to-end transit delay and/or Extended QoS information elements (if any). If such a mapping is not possible, the call shall be released towards the calling user.

In the case where the network received an Extended QoS parameters information element in the setup indication, the network shall indicate the acceptable and cumulative values of each included individual QoS parameter in the Extended QoS parameters information element in the SETUP message sent to the user.

If the network received an End-to-end transit delay information element in the setup indication, the network shall indicate the acceptable and cumulative values of the end-to-end transit delay in the End-to-end transit delay information element in the SETUP message sent to the called party.

If no Extended QoS parameters information element was contained in the received setup indication, the network may optionally generate an Extended QoS parameters information element and/or an End-to-end transit delay information element (the latter only if none is contained in the setup indication) using a local mapping from the Forward and Backward QoS class subfields in the QoS parameter information element. When such a mapping is used, the individual QoS parameters for which values are implied (from the QoS classes included in the QoS parameter information element and the ATM transfer capability of the call) must be specified, and 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). The cumulative values of parameters generated from this mapping, as included in the SETUP message sent to the called party, must account for the known amounts due to user data transfer within the network over the related connection during the data transfer phase of the call. The QoS parameter information element shall remain in the SETUP message progressed to the user.

For the handling of the cumulative transit delay, the rules in Annex B shall apply.

At the destination interface, the network shall increment the cumulative forward and backward 2-point cell delay variation values to account for the expected increases due to user data transfer within the destination local exchange. The network shall also increment the cumulative forward 2-point cell delay variation value to account for expected increases over the link between the public network and the called customer network.

If the 2-point cell delay variation parameter is received from the public network in the SETUP message, the called customer network shall increment the cumulative backward 2-point cell delay variation value to account for the expected increase due to user data transfer over the link between the public network and the called customer network. The called customer network shall also increment the cumulative forward and backward 2-point cell delay variation values to account for expected increases due to user data transfer within the called customer network.

If the user detects that any cumulative 2-point cell delay variation value exceeds the acceptable 2-point cell delay variation, the user shall reject the call with Cause #49, "*Quality of service unavailable*".

When an Extended QoS parameters information element is included, if no acceptable value of an allowed individual QoS parameter is specified (in the Extended QoS parameters or End-to-end transit delay information elements), the default is that any value of the individual QoS parameter is acceptable and the user shall continue to process the call.

If the user detects that the Extended QoS parameters information element and/or End-to-end transit delay information element contains a non-supported set of individual QoS parameters for the indicated Bearer class, Broadband transfer capability and QoS class of the call (see Annex A), the called user shall return a RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

### **10.2.2 Call/Connection acceptance (destination interface)**

If the SETUP message sent to the called user included an End-to-end transit delay information element, the called user may include an End-to-end transit delay information element in the CONNECT message specifying the final cumulative transit delay value for the call. No maximum end-to-end transit delay subfield shall be included.

If the SETUP message sent to the called user included an Extended QoS parameter information element, the called user may include an Extended QoS parameters information element delay in the CONNECT message specifying the final cumulative cell delay variation value(s) for the call. No acceptable cell delay subfield shall be included.

If the network receives an Extended QoS parameters information element and/or an End-to-end transit delay information element in the CONNECT message containing an acceptable QoS parameter field, the field shall be discarded. The network need not check the correctness of the cumulative values of QoS parameters received in the CONNECT message.

## **11 Interworking with other networks**

### **11.1 Interaction with entities which do not support the Q.2965.2 capabilities**

The capabilities described in this ITU-T Recommendation at the coincident  $S_B/T_B$  reference point are compatible with the handling of the end-to-end transit delay as described in ITU-T Recommendation Q.2931 (1995).

If an entity which does not support the capabilities described in this Recommendation ITU-T receives at the  $T_B$  reference point an End-to-end transit delay information element in a SETUP with the network-generated indicator (octet 7), it will follow the error handling procedures described in 5.7/Q.2931 [4] and 5.8/Q.2931 [4] and with the setting of the instruction indicator, as described in Appendix I, will therefore discard the End-to-end transit delay information element and proceed.

If an entity which does not support the capabilities described in this ITU-T Recommendation receives at the  $T_B$  reference point an Extended QoS parameter information element in a SETUP or CONNECT message, it will follow the error handling procedures described in 5.7/Q.2931 [4] and 5.8/Q.2931 [4] and with the setting of the instruction indicator, as described in Appendix I, will therefore discard the Extended QoS parameters information element and proceed.

### **11.2 Interworking with N-ISDN**

No interworking with N-ISDN has been identified.

## **12 Interaction with supplementary services**

The support of the capabilities covered by this ITU-T Recommendation have no impact on the support of DDI, MSN, CLIP, CLIR, COLP, COLR, SUB, UUS and CUG supplementary services as specified in ITU-T Recommendations Q.2951 [13], Q.2957 [14] and Q.2955 [15].

## **13 Interaction with other DSS2 signalling capabilities**

The support of this ITU-T Recommendation has no impact on ITU-T Recommendation Q.2962 [16] since the QoS indications are applicable to the common set or range of traffic parameter values negotiated.

The support of this ITU-T Recommendation has no impact on ITU-T Recommendations Q.2963.1 [17], Q.2963.2 [18] and Q.2963.3 [19] since the QoS of an active connection cannot be modified and therefore the QoS characteristics allocated shall be maintained unchanged.

## **14 Timers**

See clause 7/Q.2931 [4]. No additional timers are defined.

## **15 Dynamic description (SDLs)**

See Annex A/Q.2931 [4]. No additional SDLs are defined.

## ANNEX A

### Inclusion of QoS parameters

As a general principle, it is recommended that CTD and CDV objectives be signalled only if the (implicitly or explicitly) requested QoS class is real-time (e.g. I.356 QoS class 1). However, specification of the end-to-end transit delay for the non-real-time QoS classes is allowed for some combination of bearer class, broadband transfer capability, ATM traffic descriptor information elements in order to retain compatibility with ITU-T Recommendations Q.2931 [4] and Q.2961.2 [8].

Table A.1 shows the valid combination of QoS parameters when an I.356 QoS class is explicitly requested in the SETUP message (i.e. when the signalled QoS class value is different from 0). Table A.1 complements ITU-T Recommendation Q.2965.1 [3] which provides the valid combinations of the bearer classes (A, C, X, FR and VP), the ATM transfer capabilities (DBR, SBR1, SBR2, SBR3, ABR and ABT) and the corresponding traffic parameters when an I.356 QoS class is explicitly requested.

Table A.2 shows the valid combination of QoS parameters in the SETUP message when an I.371 ATM transfer capability is explicitly requested and the QoS class is not explicitly requested (i.e. when the signalled QoS class value is equal to 0). Table A.2 complements ITU-T Recommendations Q.2961.2 [8], Q.2961.3 [9], Q.2961.4 [10], Q.2961.6 [11] and Q.2934 [12] which provides the valid combinations of the bearer classes (A, C, X, FR and VP), the ATM transfer capabilities (DBR, SBR1, SBR2, SBR3, ABR and ABT) and the corresponding traffic parameters when the QoS class is not explicitly requested.

Table A.3 shows the valid combinations of QoS parameters when the requested ATC is not defined in ITU-T Recommendation I.371 [6] and the requested QoS class value is equal to 0. This table is needed to enable this Recommendation to be backward compatible with the first edition of ITU-T Recommendation Q.2931 [4] (1995) and ITU-T Recommendation Q.2961.1 [7] and also due to the implicit association of end-to-end timing requirements for some of the BTC code-points. Table A.3 complements ITU-T Recommendations Q.2934 [12] and Q.2961.2 [8] which provides the valid combinations of the bearer classes (A, C, X, FR and VP), the broadband transfer capability and ATM traffic parameters when a non I.371 ATM transfer capability is requested.

**Table A.1/Q.2965.2 – Inclusion of QoS parameters in the SETUP message when the I.356 QoS class is explicitly requested (QoS value different from 0)**

QoS parameter					
QoS class (value)	1	2	3	4	5
Transit delay (Note 1)	O				O
2-point CDV	O				O
CLR (CLP = 0) (Note 2)			O		O
CLR (CLP = 0 + 1) (Note 2)	O	O			

**Table A.2/Q.2965.2 – Inclusion of QoS parameters in the SETUP message when the QoS class value is not explicitly requested and the requested ATC is an I.371 ATC**

Broadband bearer capability								
BTC (value)	7	11	19	12	16	17	20	21
QoS parameter								
QoS class (value)	0	0	0	0	0	0	0	0
Transit delay (Note 1)	O	Note 3	O	Note 3	O	Note 3	Note 3	Note 3
2-point CDV	O		O		O			
CLR (CLP = 0) (Note 2)				O			O	O
CLR (CLP = 0 + 1) (Note 2)	O	O	O		O	O		

**Table A.3/Q.2965.2 – Inclusion of QoS parameters in the SETUP message supported for backward compatibility**

Broadband bearer capability									
Bearer class	A	X or FR	VP	C	X or FR	VP	C	X or FR	VP
BTC (value) (Note 4)	absent	4, 5 or 6	5	9	1 or 9	9	absent	absent, 0, 2, 8 or 10	absent or 10
QoS parameter									
QoS class (value)	0			0			0		
Transit delay (Note 1)	O			O			Note 3		
2-point CDV	O			O					
CLR (CLP = 0) (Note 2)	O			O			O		
CLR (CLP = 0 + 1) (Note 2)									

**Notes to Tables A.1, A.2 and A.3**

NOTE 1 – Maximum end-to-end transit delay objectives may only be specified for the forward direction.

NOTE 2 – The CLR parameter is shown as two entries to indicate explicitly whether the CLR commitment is for the CLP = 0 or for the CLP = 0 + 1 cells.

NOTE 3 – Maximum end-to-end transit delay objectives may be specified (though not recommended) for reasons of backward compatibility with ITU-T Recommendations Q.2931 (1995), Q.2934 (1998), Q.2961.1 (1996), Q.2961.2 (1997), Q.2961.3 (1997), Q.2961.4 (1997) and Q.2961.6 (1998).

NOTE 4 – BTC' values 0, 1, 2, 4, 6, 8 are not used on transmission but shall be understood on reception.

A blank in the tables for a given QoS parameter means that the given QoS parameter is not applicable for the requested combination.

O = Optional. The QoS parameter may be specified in the SETUP message for the requested combination.

## ANNEX B

### Rules for accumulation of cumulative transit delay

The cumulative transit delay expected for the transmission of user data from the calling terminal equipment to the network boundary may be indicated by the calling user.

NOTE 1 – The handling of this information within the network is described in the B-ISUP ITU-T Recommendation Q.2764 [20]. This ITU-T Recommendation states that the cumulative transit delay value is updated sequentially along the route of the call to determine the end-to-end transit delay to be expected for the call. The B-ISUP clears the call if the maximum end-to-end transit delay requirement cannot be met.

It is recommended that the called user update the cumulative transit delay value received from the network.

NOTE 2 – This is particularly important if the transmission line between the network boundary and the called terminal equipment causes substantial further delay (e.g. a satellite link).

If a maximum end-to-end transit delay value is specified, it is recommended that the called user take the appropriate action (e.g. call rejection) when the cumulative transit delay value exceeds the specified maximum end-to-end transit delay value.

If the called user accepts the call, it is recommended that the called user includes an End-to-end transit delay information element in the CONNECT message specifying the final cumulative transit delay value for the call.

NOTE 3 – The B-ISUP ITU-T Recommendations state that the cumulative transit delay value which the network receives in the CONNECT message will be passed transparently to the originating network, and that the terminating local exchange shall insert the cumulative transit delay received in forward direction, if the called user did not include an End-to-end transit delay information element in the CONNECT message.

## APPENDIX I

### Guidelines for the setting of the Instruction indicator

This appendix provides guidelines for the setting of the Instruction indicator field in the End-to-end transit delay information element and in the Extended QoS parameters information element. An implementation may choose to set the Instruction indicator differently, depending on possible specific requirements.

The recommended setting of the instruction indicator in the End-to-end transit delay information element and in the Extended QoS parameters information element is given in Table I.1:

**Table I.1/Q.2965.2 – Recommended use of the Instruction indicator**

Information element	Flag	Origin	Action indicator
End-to-end transit delay	Used	N & U	Discard information element and proceed
Extended QoS parameters	Used	N & U	Discard information element and proceed

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