INTERNATIONAL TELECOMMUNICATION UNION

ITU-T X.130

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

PUBLIC DATA NETWORKS

NETWORK ASPECTS

CALL PROCESSING DELAYS IN PUBLIC DATA NEWORKS WHEN PROVIDING INTERNATIONAL SYNCHRONOUS CIRCUIT-SWITCHED DATA SERVICES

ITU-T Recommendation X.130

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation X.130 was published in Fascicle VIII.3 of the *Blue Book*. This file is an extract from the *Blue Book.* While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation X.130

CALL PROCESSING DELAYS IN PUBLIC DATA NETWORKS WHEN PROVIDING INTERNATIONAL SYNCHRONOUS CIRCUIT-SWITCHED DATA SERVICES

(Geneva, 1980; amended at Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that Recommendation X.1 specifies the user classes of service applicable to networks offering public data services;

(b) that Recommendation X.2 specifies the international user services and facilities to be offered by public data networks;

(c) that Recommendations X.21 and X.21 *bis* define the DTE/DCE interface for circuit switched services;

(d) that Recommendation X.60 specifies the common channel signalling for synchronous data networks;

(e) that Recommendation X.71 specifies the channel associated signalling for synchronous data networks;

(f) that Recommendation X.92 specifies the hypothetical reference connections for public data networks;

(g) that Recommendation X.110 specifies the routing plan to be applied in the international portions of public data networks;

(h) that Recommendation X.213 specifies the OSI Network Layer service;

(i) that Recommendation X.140 specifies the user-oriented quality of service parameters applicable to data services,

unanimously declares

that when public data networks provide international synchronous circuit-switched data services according to Recommendations X.21 and X.21 *bis*, the values of call processing delays specified in this Recommendation shall be taken as provisional worst-case values that should not be exceeded under the conditions specified therein.

Introductory note - Design objectives that take into account both user needs and network costs are for further study.

1 Introduction

1.1 Quality of service in circuit-switched public data networks has been considered in five basic areas as follows:

i) call processing delays (Recommendation X.130);

ii) failures due to congestion (blocking) (Recommendation X.131);

iii) failures due to malfunction;

iv) loss of service; and

v) transmission performance (including throughput).

This Recommendation specifies the objectives for i) above. Each of the other areas of circuit-switching quality of service identified above will be the subject of a separate Recommendation in the X-series.

1.2 In telecommunication networks it is necessary, for economic reasons, to limit the resources provided for carrying the offered traffic. This limitation may affect the quality of service to the user of circuit-switched services in two different ways: by call processing delays and by blocking. Both of these aspects, that are consequences of the finite

traffic handling capacity of the network, constitute the grade of service. Grade of service together with malfunction, loss of service and transmission performance constitute the quality of service.

1.3 In this Recommendation the values for the network delay are quoted for two types of connection according to Recommendation X.92 as follows:

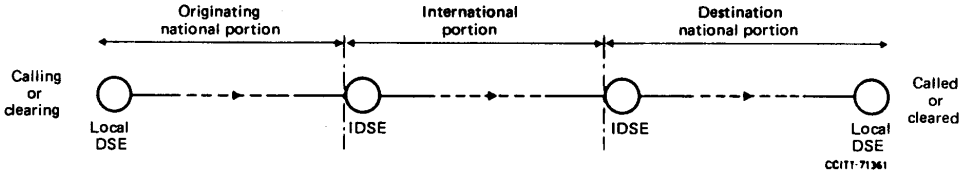
Type 1: Typical terrestrial international connection of moderate length with no satellite circuits either in the national or international portions (International portion: 1000 km).

Type 2: Long distance international connection with a satellite circuit in one national portion and two satellite circuits in the international portion (International portion: 160 000 km).

Where appropriate, values are also specified separately for the following network portions:

- originating national network,
- international portion,
- destination national network.

The boundaries for these portions are shown in Figure 1/X.130.



Note 1 – A DSE may also function as an IDSE.

Note 2 – Arrows indicate direction of call set-up or clear-down.

FIGURE 1/X.130

National/international boundaries for call set-up and clear-down functions

For the present, the values apply also to other normal routing options within the international portion.

Following the allocation of a delay allowance to the international portion of an international transit connection, it will be necessary to further apportion the allowance to individual transit networks and/or their component parts within the international portion. The means by which useful and realistic constraints can be applied, consistent with maintaining the maximum possible freedom for each involved Administration in the design and implementation of its own network, is for further study.

1.4 The values for call processing delays established in this Recommendation are to be considered as design objectives in network planning together with the forecast traffic for the planned period. The actual delay performance that will be obtained will depend on the accuracy of the traffic estimations. Normally, the actual delay performance will not coincide with the one used as a basis for planning. Furthermore, if the network is planned for the traffic forecast at the end of the period considered, the actual delay performance of the network may be better than the design value, worsening gradually to the end of the planning period as traffic increases.

The non-coincidence of busy hours in originating and destination national networks as well as in the international network will improve the overall delay performance with respect to the sum of the nominal delays of the constituent parts of the connection.

1.5 Delays are specified under conditions of normal busy hour load and are expressed where appropriate in terms of mean and 95% probability values. The term "mean" is taken to be the expected value of delay in the statistical sense. The "95% probability" value is taken as the limit within which 95% of the delays fall. Delays at higher loadings are for further study.

1.6 Call processing delays are defined for a basic call which does not include any optional user facilities, e.g. those defined in Recommendation X.21.

1.7 Where appropriate, separate limits are quoted for common channel signalling and channel associated signalling between DSEs.

For common channel signalling, the values given in this Recommendation are also applicable to lower signalling rates (less than 4800 bit/s), when the associated mode of operation is used.

1.8 The quality of service implications of regional or national satellite systems using demand assignment for resource allocation require further study.

2 Call connection delay

See Annex A for an explanation of the delay elements t1 to t6.

2.1 *Total call connection delay (TCCD)*

The **total call connection delay (TCCD)** is the time interval between the transmission of the *call request* signal and receipt of the *ready for data* signal by the calling DTE. A full explanation of the elements of TCCD is contained in Annex A. Objectives for the network-dependent components of TCCD are provided below.

2.2 *Call request delay (t1)*

Call request delay is considered to be a national matter and consequently the specification of its value is not appropriate to this Recommendation.

2.3 *Overall network post selection delay*

Overall network post selection delay is the sum of t3 and t5. It should not exceed the values given in Tables 1/X.130 and 2/X.130.

If on any call the overall network post selection delay exceeds X seconds, the call will be considered for quality of service purposes to have failed. The precise value of X is for further study but it should be at least 30 seconds.

2.4 *Network portion post selection delays (t3 + t5)*

The contribution from each network portion to the overall network post selection delay should not exceed the values given in Tables 3/X.130 and 4/X.130.

2.5 *Ready for data delay (t6)*

The need for specification of this parameter is for further study.

3 Call clearing delays

3.1 *Clear request delay (CLRD)*

Clear request delay (CLRD) is the delay between transmission of a *clear request* signal and receipt of the *DCE ready* signal by the clearing DTE. Clear request delay is considered to be a national matter and consequently the specification of its value is not appropriate to this Recommendation.

TABLE 1/X.130

Overall network post selection delay for common-channel signalling

User rate (bit/s)	Statistic	Delay (ms) Connection type	
		1	2
600	Mean	1800	3500
	95%	2700	4400
2400	Mean	1500	3200
	95%	2200	3900
4800	Mean	1300	3000
	95%	1900	3600
9600	Mean	1300	3000
	95%	1900	3600
48000	Mean	1300	3000
	95%	1900	3600

Note - See introductory note to this Recommendation.

TABLE 2/X.130

Overall network post selection delay for channel-associated signalling

User rate (bit/s)	Statistic	Delay (ms)	
		Connection type	
		1	2
600	Mean	2200	4000
	95%	3300	5100
2400	Mean	1800	3600
	95%	2700	4500
4800	Mean	1700	3500
	95%	2500	4400
9600	Mean	1600	3400
	95%	2400	4200
48000	Mean	1500	3300
	95%	2200	4100

Note - See introductory note to this Recommendation.

TABLE 3/X.130

Contributions to network post selection delays for common-channel signalling

User rate (bit/s)	Statistic	Originating national portion (ms)		Destination national portion (ms)		International portion (ms)	
		Number of satellites		Number of satellites		Connection type	
		0	1	0	1	1	2
600	Mean	700	1200	800	1300	300	1500
	95%	1100	1600	1200	1800	500	1700
2400	Mean	600	1100	700	1200	200	1400
	95%	900	1500	1100	1600	300	1600
4800	Mean	500	1000	600	1100	200	1400
	95%	800	1300	900	1500	300	1600
9600	Mean	500	1000	600	1100	200	1400
	95%	800	1300	900	1500	300	1600
48000	Mean	500	1000	600	1100	200	1400
	95%	800	1300	900	1500	300	1600

Note - See introductory note to this Recommendation.

TABLE 4/X.130

Contributions to network post selection delays for channel-associated signalling

User rate (bit/s)	Statistic	Originating national portion (ms)		Destination national portion (ms)		International portion (ms)	
		Number of satellites		Number of satellites		Connection type	
		0	1	0	1	1	2
600	Mean	800	1300	1000	1500	400	1700
	95%	1200	1800	1500	2100	600	2000
2400	Mean	700	1200	800	1300	300	1600
	95%	1100	1600	1200	1800	500	1900
4800	Mean	600	1100	800	1300	300	1600
	95%	900	1500	1200	1800	500	1900
9600	Mean	600	1100	700	1200	300	1600
	95%	900	1500	1100	1600	500	1900
48000	Mean	600	1100	700	1200	200	1500
	95%	900	1500	1100	1600	400	1700

Note - See introductory note to this Recommendation.

3.2 *Network clear indication delay (NCID)*

Network clear indication delay (NCID) is the delay between transmission of a *clear request* signal by the clearing DTE and the receipt of the DCE *clear indication* signal by the cleared DTE. It should not exceed the values given in Tables 5/X.130 and 6/X.130.

If on any call the overall network clear indication delay exceeds Y seconds the call will be considered for quality of service purposes to have failed. The precise value of Y is for further study but it should be at least 30 seconds.

TABLE 5/X.130

Overall network clear indication delay for common-channel signalling

User rate (bit/s)	Statistic	Delay (ms)	
		Connection type	
		1	2
600	Mean	900	1900
	95%	1300	2400
2400	Mean	700	1700
	95%	1100	2100
4800	Mean	600	1600
	95%	900	1900
9600	Mean	600	1600
	95%	900	1900
48000	Mean	600	1600
	95%	900	1900

Note - See introductory note to this Recommendation.

TABLE 6/X.130

Overall network clear indication delay for channel-associated signalling

User rate (bit/s)	Statistic	Delay (ms)	
		Connection type	
		1	2
600	Mean	1100	2100
	95%	1600	2700
2400	Mean	900	1900
	95%	1300	2400
4800	Mean	800	1800
	95%	1200	2300
9600	Mean	800	1800
	95%	1200	2300
48000	Mean	800	1800
	95%	1200	2300

Note - See introductory note to this Recommendation

3.3 *Network portion clear indication delay (NPCID)*

The contribution from each network portion to the overall network clear indication delay should not exceed the values given in Tables 7/X.130 and 8/X.130.

TABLE 7/X.130

Contributions to network clear indication delay for common-channel signalling

User rate (bit/s)	Statistic	Originating national portion (ms)		Destination national portion (ms)		International portion (ms)	
		Number of satellites		Number of satellites		Connection type	
		0	1	0	1	1	2
600	Mean	300	600	400	700	200	900
	95%	500	800	600	900	300	1100
2400	Mean	200	500	300	600	200	900
	95%	300	600	500	800	300	1100
4800	Mean	200	500	300	600	100	800
	95%	300	600	500	800	200	900
9600	Mean	200	500	300	600	100	800
	95%	300	600	500	800	200	900
48000	Mean	200	500	300	600	100	800
	95%	300	600	500	800	200	900

Note - See introductory note to this Recommendation

TABLE 8/X.130

Contributions to network clear indication delay for channel-associated signalling

User rate (bit/s)	Statistic	Originating national portion (ms)		Destination national portion (ms)		International portion (ms)	
		Number of satellites		Number of satellites		Connection type	
		0	1	0	1	1	2
600	Mean	400	700	500	800	200	900
	95 %	600	900	800	1100	300	1100
2400	Mean	300	600	400	700	200	900
	95 %	500	800	600	900	300	1100
4800	Mean	300	600	300	600	200	900
	95 %	500	800	500	800	300	1100
9600	Mean	300	600	300	600	200	900
	95 %	500	800	500	800	300	1100
48000	Mean	300	600	300	600	200	900
	95 %	500	800	500	800	300	1100

Note - See introductory note to this Recommendation.

3.4 *Clear confirmation delay (CLCD)*

Clear confirmation delay (CLCD) is the delay between transmission of a *DTE clear confirmation* signal and receipt of a *DCE ready* signal by the cleared DTE. Clear confirmation delay is considered to be a national matter and consequently the specification of its value is not appropriate to this Recommendation.

ANNEX A
(to Recommendation X.130)

A.1 *Total call connection delay (TCCD) elements*

The total call connection delay is the sum of the following elements (see Figure A- I /X. 1 30):

t1: delay between transmission of the *call request* signal and receipt of the *proceed to select* signal by the calling DTE.

t2: time between receipt of the *proceed to select* signal and transmission of the *end of selection* signal by the calling DTE.

t3: delay between transmission of the *end of selection* signal by the calling DTE and receipt of the *incoming call* signal by the called DTE.

t4: delay between receipt of the *incoming call* signal and transmission of the *call accepted* signal by the called DTE.

and if t5 > t6,

t5: delay between transmission of the *call accepted* signal by the called DTE and receipt of the *ready for data* signal by the calling DTE.

or if t5 < t6,

t6: delay between transmission of the *call accepted* signal and receipt of the *ready for data* signal by the called DTE.

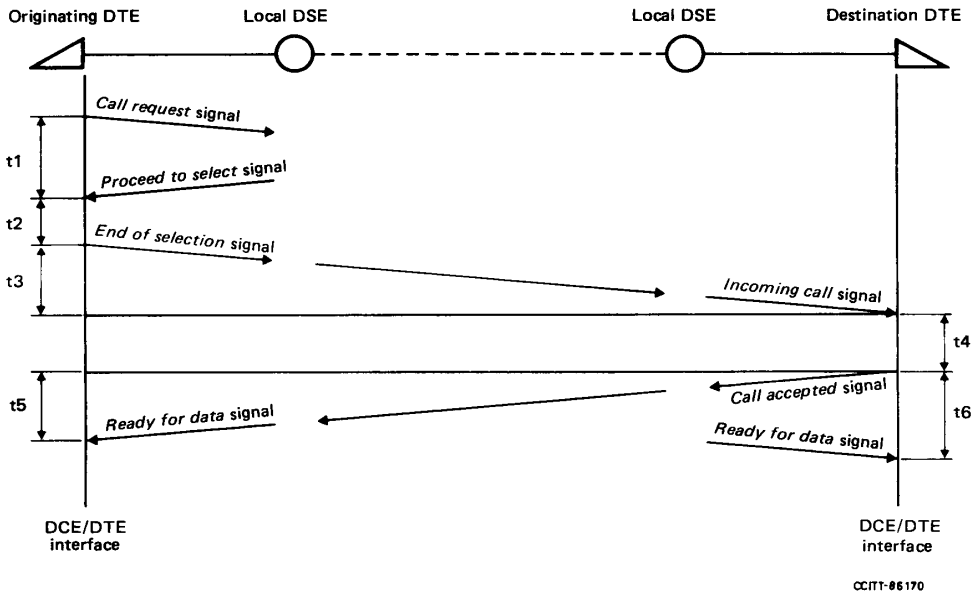


FIGURE A-1/X.130

Total call connection delay (TCCD)

A.1.1 *User-dependent call connection delay (UCCD)*

Considering the above elements of TCCD, t2 is dependent on the source DTE. Similarly t4 is dependent on the destination DTE. it is therefore inappropriate to specify values for these times in this Recommendation, but the following observations are relevant:

A.1.1.1 *Selection time (t2)*

Selection times for automatic calls from the DTE are given in Table A-1/X.130.

TABLE A-1/X.130

Selection time

User rate (bit/s)	Selection time (t2) (ms)
600	260
2400	70
4800	40
9600	20
48000	5

A.1.1.2 *Call acceptance delay (CAD) (t4)*

If the CAD exceeds 500 ms with automatic answer or 60 seconds with manual answer the DCE will initiate clearing.

A.1.2 *Network-dependent call connection delay (NCCD)*

Considering the elements of TCCD in § A.1, it has been shown in § A.1.1 that t2 and t4 are user-dependent and are not regarded as network performance parameters.

The network (dependent) call connection delay is therefore the sum of the remaining elements. Hence:

$$NCCD = t1 + t3 + t5$$