INTERNATIONAL TELECOMMUNICATION UNION

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CONSULTATIVE COMMITTEE

RED BOOK

VOLUME VIII   —   FASCICLE VIII.2

DATA COMMUNICATION NETWORKS

SERVICES AND FACILITIES

RECOMMENDATIONS X.1-X.15

INTERNATIONAL TELECOMMUNICATION UNION

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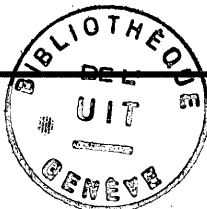
VOLUME VIII – FASCICLE VIII.2

DATA COMMUNICATION NETWORKS

SERVICES AND FACILITIES

RECOMMENDATIONS X.1-X.15

VIIITH PLENARY ASSEMBLY
MALAGA-TORREMOLINOS, 8-19 OCTOBER 1984

CONTENTS OF THE CCITT BOOK
APPLICABLE AFTER THE EIGHTH PLENARY ASSEMBLY (1984)

RED BOOK

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Recommendations X.1 to X.15

Data communication networks

Services and facilities

PRELIMINARY NOTES

1   The Questions entrusted to each Study Group for the Study Period 1985-1988 can be found in Contribution No. 1 to that Study Group.

2   In this fascicle, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

3   The status of annexes and appendices attached to the Series X Recommendations should be interpreted as follows:

    —   an *annex* to a Recommendation forms an integral part of the Recommendation;

    —   an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

FASCICLE VIII.2

Recommendations X.1 to X.15

DATA COMMUNICATION NETWORKS

SERVICES AND FACILITIES

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PRINCIPLES GOVERNING THE COLLABORATION BETWEEN THE CCITT AND OTHER INTERNATIONAL ORGANIZATIONS IN THE STUDY OF DATA COMMUNICATIONS

Recommendation A.20 published in Volume I is reproduced below for the convenience of the reader of the Series X Recommendations.

Recommendation A.20

COLLABORATION WITH OTHER INTERNATIONAL ORGANIZATIONS OVER DATA TRANSMISSION

(Geneva, 1964; amended at Mar del Plata, 1968, and at Geneva, 1972, 1976 and 1980; Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that, according to Article 1 of the agreement between the United Nations and the International Telecommunication Union, the United Nations recognizes the International Telecommunication Union as the specialized agency responsible for taking such action as may be appropriate under its basic instrument for the accomplishment of the purposes set forth therein;

(b) that Article 4 of the International Telecommunication Convention (Nairobi, 1982) states that the purposes of the Union are:

"a) to maintain and extend international cooperation between all Members of the Union for the improvement and rational use of telecommunications of all kinds, as well as to promote and to offer technical assistance to developing countries in the field of telecommunications;

b) to promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, so far as possible, generally available to the public;

c) to harmonize the actions of nations in the attainment of those ends;"

(c) that Article 40 of the Convention states that, in furtherance of complete international coordination on matters affecting telecommunication, the Union shall cooperate with international organizations having related interests and activities;

(d) that in the study of data transmission the CCITT has to collaborate with the organizations dealing with data processing and office equipment and particularly the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC);

(e) that this collaboration has to be organized in a manner that will avoid duplication of work and decisions that would be contrary to the principles set out above;

unanimously declares the view

that international standards for data transmission should be established with the following considerations in mind:

(1) Clearly it will be the responsibility of the CCITT to lay down standards for *transmission channels*, i.e. aspects of data transmission which require a knowledge of telecommunication networks or affect performance of these networks.

(2) The standardization of signal conversion terminal equipment (modems) is the province of the CCITT; the standardization of the junction (interface) between modem and the data terminal equipment is a matter of agreement between the CCITT and the ISO or the IEC.

(3) Devices designed to detect and (or) correct errors must take account of:

— the error rate tolerable to the user;

— the line transmission conditions;

— the code, which has to meet the exigencies of the data alphabet and the requirements of error control (this must be such as to give an output satisfactory to the user) together with the requisite signalling (synchronism, repetition signals, etc.).

Standardization here may not come wholly within the CCITT's province, but the CCITT has very considerable interests at stake.

(4) The alphabet (as defined in Fascicle X.1 — Terms and Definitions) is a "table of correspondence between an agreed set of characters and the signals which represent them".

The CCITT and the ISO reached agreement on an alphabet for general (but not exclusive) use for data and message transmission and have standardized a common alphabet which is known as International Alphabet No. 5 (CCITT Recommendation T.50 and ISO Standard No. 646-1983; ISO 7-bit coded character set for information interchange).

Complementary study of some control characters of the alphabet should be effected cooperatively.

(5) Coding (as defined in Fascicle X.1 — Terms and Definitions) is "a system of rules and conventions according to which the telegraph signals forming a message or the data signals forming a block should be formed, transmitted, received and processed". Hence, it consists of a transformation of the format of the signals in the alphabet for taking account of synchronous methods, and introduction of redundancy in accordance with the error control system. This is not a field in which the CCITT alone may be able to decide; however, no decision should be taken without reference to the Committee, because of the possible restrictions which transmission and switching peculiarities may impose on coding.

When the general switched network is used (telephone or telex) and when the error control devices are subject to restrictions (switching signals — reserved sequences), it is the CCITT which is in fact responsible for any necessary standardization in conjunction with other bodies.

(6) The limits to be observed for transmission performance on the transmission path (modem included) fall within the competence of the CCITT; the limits for the transmission performance of the sending equipment and the margin of terminal data equipment (depending on the terminal apparatus and the transmission path limits) should be fixed by agreement between the ISO and the CCITT.

(7) In all instances, the CCITT alone can lay down manual and automatic operating procedures for the setting-up, holding and clearing of calls for data communications when the general switched networks are used, including type and form of signals to be interchanged at the interface between data terminal equipment and data circuit terminating equipment.

(8) When a public data network is involved, the CCITT has the responsibility to provide the Recommendations which apply. Where these Recommendations have an impact on the basic design and features of data processing systems and office equipment [normally the Data Terminal Equipment (DTE)], they shall be the subject of consultation between CCITT and ISO and in some cases a mutual agreement may be desirable. Likewise when the ISO is developing or changing standards that may affect compatibility with the public data network there shall be consultation with the CCITT.

SECTION 1

SERVICES AND FACILITIES

INTERNATIONAL USER CLASSES OF SERVICE
IN PUBLIC DATA NETWORKS AND INTEGRATED
SERVICES DIGITAL NETWORKS (ISDNs)

(Geneva, 1972; amended at Geneva, 1976 and 1980 and Malaga-Torremolinos, 1984)

Preface

The establishment in various countries of public networks for data transmission and ISDNs for integrated services creates a need to standardize user classes of service. An international user class of service is a category of data transmission service in which the data signalling rate, call control signalling rates and data terminal equipment operation modes are standardized.

Recommendations in the V Series already standardize data signalling rates for data transmission in the general telephone network and modulation rates for modems. These rates are, however, not necessarily the most suitable for public networks devoted entirely to data transmissions.

There are three public data transmission services, namely circuit-switched, packet-switched and leased circuit.

There are several methods by which data terminal equipment (DTE) may gain access to the public data transmission services. These methods are direct connections and a variety of switched connections via other public networks. To enable the method of access to be identified in addition to the user class of service, categories of access are defined in Recommendation X.10.

It is not mandatory for Administrations to provide all the user classes of service contained in this Recommendation.

The CCITT,

considering

(a) the desirability of providing sufficient data signalling rates to meet users' needs;

(b) the requirement to optimize data terminal equipment (DTE), transmission and switching costs to provide an overall economic service to the user;

(c) the particular operating modes of users' data terminal equipment (DTE);

(d) the users' need to transfer information consisting of any bit sequence and of any number of bits up to a certain amount;

(e) the interaction between users' requirements, technical limitations and tariff structure;

(f) that Recommendation X.10 defines the categories of access for data terminal equipment (DTE) to public data transmission services,

unanimously declares the view

that users' data transmission requirements via public data networks and ISDNs may best be served by defined international user classes of service.

These international user classes of service are shown in the following tables.

TABLE 1/X.1

International user classes of service in public data networks and ISDNs

(see Notes 1 to 17)

a)   *Circuit switched and leased circuit data transmission services for data terminal equipment operating in start-stop mode, using X.20 or X.20 bis interfaces* (see Note 1)

User class of service	Data signalling rate and code structure in the data transfer phase (see Notes 7 and 8)	Call control signals in the call control phase (see Note 6)
1	300 bit/s, 11* units/character start-stop (see Note 2)	300 bit/s, International Alphabet No. 5 (11 units/character) start-stop
2	50 to 200 bit/s, 7,5 to 11* units/character start-stop (see Notes 3 and 5)	200 bit/s, International Alphabet No. 5 (11 units/character) start-stop (see Note 4)

* Usage in accordance with Recommendation X.4.

b)   *Circuit switched and leased circuit data transmission services for data terminal equipment operating in synchronous mode, using X.21 or X.21 bis interfaces*

User class of service	Data signalling rate in the data transfer phase (see Notes 8 and 10)	Call control signals in the call control phase (see Note 9)
3	600 bit/s	600 bit/s, International Alphabet No. 5
4	2 400 bit/s	2 400 bit/s, International Alphabet No. 5
5	4 800 bit/s	4 800 bit/s, International Alphabet No. 5
6	9 600 bit/s	9 600 bit/s, International Alphabet No. 5
7	48 000 bit/s	48 000 bit/s, International Alphabet No. 5

c)   *Packet switched data transmission service for data terminal equipment operating in synchronous mode, using X.25 interface* (see Note 11)

User class of service	Data signalling rate (see Note 13)
8	2 400 bit/s
9	4 800 bit/s
10	9 600 bit/s
11	48 000 bit/s
12	1 200 bit/s (see Note 12)

d)   *Packet switched data transmission service for data terminal equipment operating in start-stop mode, using X.28 interface* (see Note 11)

User class of service	Data signalling rate and code structure
20	50-300 bit/s, 10 or 11 units/character
21	75/1200 bit/s, 10 units/character (see Notes 14 and 15)
22	1200 bit/s, 10 units/character (see Notes 16 and 17)

International user classes of service specific to ISDN

(see Notes 18 and 19)

User class of service	Data signalling rate	DTE/DCE interface requirements and call control signals
30	64 kbit/s	The call control signals used will be in accordance with those defined for ISDN at reference point S. For an interim period, interfaces according to Recommendations X.21 and X.21 *bis* can be used at reference point R. In this case call control signal at the DTE/DCE interface shall be at the 64 kbit/s data signalling rate at reference point R. Reference points S and R are defined in Recommendation I.411.

Note 1 — There is no user class of service for the data signalling rate of 50 bit/s, the transmission mode of 7.5 units/character start-stop and address selection and call progress signals at 50 bit/s, International Telegraph Alphabet No. 2. However, several Administrations have indicated that their telex service (50-baud, International Telegraph Alphabet No. 2) will be provided as one of the many services carried by their public data network.

Note 2 — Taking account of the existence of data terminal equipments operating in the start-stop mode at a data signalling rate of 300 bit/s and with a 10 unit/character code structure, some Administrations have indicated that their public data networks will accommodate such terminals. Other Administrations, however, have indicated that they cannot guarantee acceptable transmission if such terminals are connected to their networks.

Note 3 — Class 2 will provide, in the data transfer phase, for operation at the following data signalling rates and code structures:

> 50   bit/s (7.5 units/character)
> 100   bit/s (7.5 units/character)
> 110   bit/s (11 units/character)
> 134.5 bit/s (9 units/character)
> 200   bit/s (11 units/character)

Call control signals would be at 200 bit/s, International Alphabet No. 5 (11 units/character) as indicated in a) of Table 1/X.1.

Note 4 — Some Administrations have indicated that, for certain of the data signalling rates listed in Note 3 above, they will permit users in class 2 to operate the same signalling rate and code structure for both data transfer and address selection and to receive call progress signals at these signalling rates and code structures. Where International Alphabet No. 5 is used for the call control signals, the appropriate parts of Recommendation X.20 shall apply.

Note 5 — For international user class of service 2, it should be noted that some public data networks may not be able to prevent two terminals working at different data signalling rates and code structures from being connected together by means of a circuit-switched connection.

Note 6 — Only applicable for the circuit-switched data transmission service.

Note 7 — The support of user classes 1 and 2 in ISDN is for further study.

Note 8 — Some Administrations are planning to offer a circuit-switched asynchronous service for terminal operating at the data signalling rate of: 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s. 10 units/character, start-stop in the data transfer phase and respectively 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, International Alphabet No. 5, 10 units/character, start-stop in the call control phase. This service would be supported by synchronous network bearer channels.

Note 9 — Only applicable for the circuit-switched data transmission service, using the Recommendation X.21 interface.

Note 10 — The support of user classes of service 3 to 7 in the ISDN is provided by means of a terminal adaptor (in accordance with Recommendation X.30). The concept of terminal adaptor functional grouping is defined in Recommendation I.411.

Note 11 — The packet-switched data transmission service allows for communication between Recommendations X.25 and/or X.28 data terminal equipments operating at different data signalling rates.

Note 12 — The user class of service 12 is only provided via PSTN access. It might also be offered in the maritime satellite data transmission system.

Note 13 — The support of user classes of service 8 to 11 in the ISDN is provided by means of a terminal adaptor (in accordance with Recommendation X.31). The concept of terminal adaptor functional grouping is defined in Recommendation I.411. The support of user class 12 in the ISDN is for further study.

Note 14 — 75 bit/s from DTE to DCE, 1200 bit/s from DCE to DTE.

Note 15 — This user class of service will not be supported by all Administrations.

Note 16 — The support of user classes of service 20 to 22 in the ISDN may be provided by means of a terminal adaptor providing PAD functions. Other means to support these user classes of service in the ISDN are for further study.

Note 17 — Some Administrations may offer higher speeds.

Note 18 — Class 30 is valid for both circuit switching and packet switching.

Note 19 — The packet-switched data transmission service allows for communication between ISDN packet mode terminal equipments operating at 64 kbit/s (Terminal Equipment 1 according to Recommendation I.411) and Recommendation X.25 or X.28 data terminal equipments operating at different data signalling rates.

APPENDIX I

(to Recommendation X.1)

List of terms

The following terms are contained in this Recommendation. References to definitions, implicit or explicit, are included where appropriate and where available.

C

Call control signal
cont. in X.1; expl. def. in X.15

Category of access
cont. in X.1; impl. def. in X.10

Circuit-switched data transmission service
cont. in X.1; expl. def. in X.15

Control phase
cont. in X.1

D

Data signalling rate
cont. in X.1; expl. def. in X.15

Data terminal equipment
cont. in X.1; expl. def. in X.15

Data transmission service
cont. in X.1; impl. def. in X.2; expl. def. in X.15

I

Interface
cont. in X.1; expl. def. in X.15

ISDN — integrated services digital network
cont. in X.1

L

Leased circuit data transmission service
cont. in X.1; expl. def. in X.15

P

Packet-switched data transmission service
cont. in X.1; expl. def. in X.15

Public data network
cont. in X.1; expl. def. in X.15

R

Reference point R
cont. in X.1; impl. def. in I.411

Reference point S
cont. in X.1; impl. def. in I.411

S

Start-stop mode
cont. in X.1

Synchronous mode
cont. in X.1

T

Terminal adaptor
cont. in X.1; impl. def. in X.31

Terminal equipment 1
cont. in X.1; impl. def. in I.411

Terminal operating mode
cont. in X.1; expl. def. in X.15

Transfer phase
cont. in X.1

U

User class of service
cont. in X.1; impl. def. in X.1; expl. def. in X.15

INTERNATIONAL DATA TRANSMISSION SERVICES
AND OPTIONAL USER FACILITIES IN PUBLIC DATA NETWORKS

(Geneva, 1972; amended at Geneva, 1976, 1980 and Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) the international user classes of service and categories of access defined in Recommendations X.1 and X.10;

(b) the need to standardize data transmission services and optional user facilities in public data networks which should be made available on an international basis;

(c) the need to standardize additional optional user facilities which may be provided by Administrations and which may be available on an international basis;

(d) the impact which these optional user facilities could have on tariff structures,

unanimously declares

(1) that the optional user facilities should be standardized for each of the user classes of service indicated in Recommendation X.1 for each of the following:

i)   circuit switched data transmission services;

ii)   packet switched data transmission services;

iii)   leased circuit data transmission services.

(2) that the optional user facilities to be available on an international basis are as indicated in Table 1/X.2. Some of the optional user facilities are available on a per-call basis and others may be assigned for an agreed contractual period. In all cases the user has the option of requesting a given optional user facility.

TABLE 1/X.2

International data transmission services and
optional user facilities in public data networks

a)   *Circuit switched data transmission service* (see Notes 1 and 2)

Optional user facility (see Note 6)	All user classes of service
1. *Optional user facilities assigned for an agreed contractual period*	
1.1 Direct call	A
1.2 Closed user group	E
1.3 Closed user group with outgoing access	A
1.4 Closed user group with incoming access	A
1.5 Incoming calls barred within a closed user group	A
1.6 Outgoing calls barred within a closed user group	A
1.7 Calling line identification	A
1.8 Called line identification	A
1.9 Bilateral closed user group	A
1.10 Bilateral closed user group with outgoing access	A
1.11 Incoming calls barred	A
1.12 Reverse charging acceptance	A
1.13 Connect when free	A
1.14 Waiting allowed	A
1.15 Redirection of calls	A
1.16 On-line facility parameter registration/cancellation	A
1.17 DTE inactive registration/cancellation	A
1.18 Date and time indication	A
1.19 Hunt group	A
2. *Optional user facilities requested by the DTE on a per-call basis*	
2.1 Direct call	A
2.2 Abbreviated address calling	A
2.3 Multi-address calling (see Note 7)	A
2.4 Reverse charging	A
2.5 RPOA selection	A
2.6 Charging information	A
2.7 Called line identification	A

b1)   *Packet switched data transmission services* (see Notes 1, 2, 3 and 4)

Services	User classes of service	
	8-11	20-22
Virtual call service	E	E
Permanent virtual circuit service (see Note 8)	E	FS

b2) *Facilities of packet switched data networks* (see Notes 1-3, 9)

Optional user facility (see Note 6)	User classes of service			
	8-11		20-22 (see Note 5)	
	VC	PVC	VC	PVC
1. *Optional user facilities assigned for an agreed contractual period*				
1.1 Extended packet sequence numbering (module 128)	A	A	–	–
1.2 Nonstandard default window sizes	A	A	–	–
1.3 Nonstandard default packet sizes 16, 32, 64, 256, 512, 1024, 2048, 4096	A	A	FS	FS
1.4 Default throughput classes assignment	A	A	FS	FS
1.5 Flow control parameter negotiation	E	–	FS	–
1.6 Throughput class negotiation	E	–	FS	–
1.7 Packet retransmission	A	A	–	–
1.8 Incoming calls barred	E	–	A	–
1.9 Outgoing calls barred	E	–	A	–
1.10 One-way logical channel outgoing	E	–	–	–
1.11 One-way logical channel incoming	A	–	–	–
1.12 Closed user group	E	–	E	–
1.13 Closed user group with outgoing access	A	–	A	–
1.14 Closed user group with incoming access	A	–	A	–
1.15 Incoming calls barred within a closed user group	A	–	A	–
1.16 Outgoing calls barred within a closed user group	A	–	A	–
1.17 Bilateral closed user group	A	–	A	–
1.18 Bilateral closed user group with outgoing access	A	–	A	–
1.19 Reverse charging acceptance	A	–	A	–
1.20 Fast select acceptance	E	–	FS	–
1.21 Multilink procedure	A	A	–	–
1.22 Charging information	A	–	A	–
1.23 Direct call	FS	–	A	–
1.24 Hunt group	A	–	A	–
1.25 On-line facility registration	A	–	FS	–
1.26 D-bit modification	A	A	FS	–
1.27 Local charging prevention	A	–	FS	–
1.28 Call redirection	A	–	FS	–
1.29 Network user identification	A	–	A	–
1.30 Extended frame sequence numbering	A	A	–	–
1.31 RPOA selection	A	–	A	–
2. *Optional user facilities on a per-call basis*				
2.1 Closed user group selection	E	–	E	–
2.2 Bilateral closed user group selection	A	–	FS	–
2.3 Reverse charging	A	–	A	–
2.4 RPOA selection	A	–	A	–
2.5 Flow control parameter negotiation	E	–	–	–
2.6 Fast select	E	–	FS	–
2.7 Throughput class negotiation	E	–	–	–
2.8 Abbreviated address calling	FS	–	A	–
2.9 Charging information	A	–	A	–
2.10 Transit delay selection and indication (see Note 10)	E	–	–	–
2.11 Call redirection notification	A	–	FS	–
2.12 Called line address modified notification	A	–	FS	–
2.13 Network user identification	A	–	A	–
2.14 Closed user group with outgoing access selection	A	–	FS	–

c) *Leased circuit data transmission services* (see Note 1)

Optional User facility (see Note 6)	User classes of service	
	1-2	3-7
1. *Point to point*	E	E
2. *Multipoint*		
2.1 Centralized multipoint	A	A
2.2 Decentralized multipoint	A	A
2.3 Broadcasting	A	A

E: an essential user service or facility to be made available internationally

A: an additional user service or facility which may be available in certain data networks and may also be available internationally

FS: for further study

−: not applicable

VC: applicable when the virtual call service is being used

PVC: applicable when the permanent virtual circuit service is being used

Note 1 — Recommendation X.10 defines the various categories of access to public data communication services.

Note 2 — The subject of interworking between the packet switching service and the circuit switching service is for further study.

Note 3 — It is assumed in b) of Table 1/X.2 that all terminals are directly connected to a packet-switched network and may make use of one or more of the services of this network (i.e., virtual call, permanent virtual call). The case of terminals not directly connected to a packet-switched network is for further study.

Note 4 — The study of "connectionless services" is for further study (see new Question 1A/VII).

Note 5 — The use of a PAD function is assumed for virtual call service (see Recommendation X.3). Its applicability for permanent virtual circuit service is for further study.

Note 6 — The optional user facilities in this table are applicable to those requested by the DTE on a per call basis and to those provided for an agreed contractual period.

Note 7 — This optional user facility provides also the user with the capability to request the establishment of a point-to-multipoint configuration amongst the following: centralized multipoint, decentralized multipoint, broadcasting.

Note 8 — This service may not be available for all international connections and may not be available for the maritime mobile services. The international application depends on bilateral agreement. Full international application is for further study.

Note 9 — The Recommendation X.25 interface has inherent features (e.g. the conveying of an address extension), which can be used end-to-end by the users for providing a full OSI network service. Such features are described within Recommendation X.25 and are so-called "DTE facilities". (See Recommendation X.25, Annex H.)

Note 10 — Attention of users is drawn to the fact that the implementation of such a facility might happen with different time schedules, depending on national conditions.

APPENDIX I

(to Recommendation X.2)

List of terms

The following terms are contained in this Recommendation. References to definitions, implicit or explicit, are included where appropriate and where available.

A

Abbreviated address calling
cont. in X.2; impl. def. in X.20, X.21

B

Bilateral closed user group
cont. in X.2; impl. def. in X.300

Bilateral closed user group selection
cont. in X.2; impl. def. in X.300

Bilateral closed user group with outgoing access
cont. in X.2; impl. def. in X.300

Broadcasting
cont. in X.2

C

Call redirection
cont. in X.2; impl. def. in X.300

Call redirection notification
cont. in X.2; impl. def. in X.300

Called line address modified notification
cont. in X.2; impl. def. in X.300

Called line identification
cont. in X.2; impl. def. in X.300

Calling line identification
cont. in X.2; impl. def. in X.300

Centralized multipoint
cont. in X.2; impl. def. in X.21

Charging information
cont. in X.2

Circuit-switched data transmission service
cont. in X.2; impl. def. in X.15

Closed user group
cont. in X.2; impl. def. in X.300

Closed user group selection
cont. in X.2; impl. def. in X.300

Closed user group with incoming access
cont. in X.2; impl. def. in X.300

Closed user group with outgoing access
cont. in X.2; impl. def. in X.300

Closed user group with outgoing access selection
cont. in X.2; impl. def. in X.300

Connect when free
cont. in X.2; impl. def. in X.300

D

D-bit modification
cont. in X.2; impl. def. in X.25

Data transmission service
cont. in X.2; impl. def. in X.2

Date and time indication
cont. in X.2; impl. def. in X.20, X.21

Decentralized multipoint
cont. in X.2

Default throughput classes assignment
cont. in X.2; impl. def. in X.25

Direct call
cont. in X.2; impl. def. in X.20, X.21

DTE inactive registration/cancellation
cont. in X.2; impl. def. in X.20, X.21

E

Extended frame sequence numbering
cont. in X.2; impl. def. in X.25

Extended packet sequence numbering
cont. in X.2; impl. def. in X.25

F

Fast select
cont. in X.2; impl. def. in X.25

Fast select acceptance
cont. in X.2; impl. def. in X.25

Flow control parameter negotiation
cont. in X.2; impl. def. in X.25

H

Hunt group
cont. in X.2; impl. def. in X.300

I

Incoming calls barred
cont. in X.2; impl. def. in X.300

Incoming calls barred within a closed user group
cont. in X.2; impl. def. in X.300

International data transmission service
cont. in X.2; impl. def. in X.2

L

Leased circuit data transmission service
cont. in X.2; impl. def. in X.15

Local charging prevention
cont. in X.2

M

Multi-address calling
cont. in X.2; impl. def. in X.20, X.21

Multilink procedure
cont. in X.2; impl. def. in X.25

Multipoint
cont. in X.2

N

Network user identification
cont. in X.2; impl. def. in X.300

Nonstandard default packet sizes
cont. in X.2; impl. def. in X.25

Nonstandard default window sizes
cont. in X.2; impl. def. in X.25

O

On-line facility parameter registration/cancellation
cont. in X.2

On-line facility registration
cont. in X.2

One-way logical channel incoming
cont. in X.2; impl. def. in X.25

One-way logical channel outgoing
cont. in X.2; impl. def. in X.25

Optional user facility
cont. in X.2; impl. def. in X.15

Outgoing calls barred
cont. in X.2; impl. def. in X.25

Outgoing calls barred within a closed user group
cont. in X.2; impl. def. in X.300

P

Packet retransmission
cont. in X.2; impl. def. in X.25

Packet-switched data transmission service
cont. in X.2; impl. def. in X.15

Point-to-point
cont. in X.2

R

Redirection of calls
cont. in X.2; impl. def. in X.300

Reverse charging
cont. in X.2; impl. def. in X.20, X.21, X.25

Reverse charging acceptance
cont. in X.2; impl. def. in X.25

RPOA selection
cont. in X.2; impl. def. in X.300

Recommendation X.3

PACKET ASSEMBLY/DISASSEMBLY FACILITY (PAD)
IN A PUBLIC DATA NETWORK

(provisional, Geneva, 1977; amended at Geneva, 1980 and Malaga-Torremolinos, 1984)

Preface

The establishment in various countries of public data networks providing packet switched data transmission services creates a need to produce standards to facilitate access from the public telephone network, circuit switched public data networks and leased circuits.

The CCITT,

considering

(a) that Recommendations X.1 and X.2 define the user classes of service and user facilities in public data networks, Recommendation X.96 defines call progess signals, Recommendation X.29 defines the procedures between a packet assembly/disassembly facility (PAD) and a packet mode DTE or another PAD, Recommendation X.28 defines the DTE/DCE interface for a start-stop mode DTE accessing the PAD;

(b) that the logical control links for packet switched data transmission services are defined in Recommendation X.92, and that in particular Recommendation X.92 allows for the incorporation of a PAD;

(c) the urgent need to allow interworking between a start-stop mode DTE on a public switched telephone network, a public switched data network or a leased circuit, and a packet mode DTE or another start-stop mode DTE using the virtual call facility of the packet switched data service;

(d) that DTEs operating in the start-stop mode will send and receive network control information and user information in the form of characters or the break signals;

(e) that DTEs operating in the packet mode will send and receive network control information and user information in the form of packets in accordance with Recommendation X.25;

(f) that the packet mode DTE shall not be obliged to use the control procedures for PAD functions, but that some packet mode DTEs may wish to control specific functions of the PAD;

unanimously declares

(1) that the functions performed by and operational characteristics of the PAD for the start-stop mode DTE are described below in § 1 *Description of the basic functions and user selectable functions of the PAD;*

(2) that the operation of the PAD for the start-stop mode DTE should depend on the possible values of internal variables known as PAD parameters which are described below in § 2 *Characteristics of PAD parameters;*

(3) that the PAD parameters for the start-stop mode DTE and their possible values should be those which are listed below in § 3 *List of PAD parameters and possible values;*

(4) that the PAD features described in §§ 1, 2 and 3 below could be expanded by future studies to allow interworking with non packet mode DTEs other than start-stop mode DTEs.

1 Description of the basic functions and user selectable functions of the PAD

1.1 The PAD performs a number of functions and exhibits operational characteristics. Some of the functions allow either or both the start-stop mode DTE and the packet mode DTE (or remote PAD) to configure the PAD so that its operation is adapted to the start-stop mode DTE characteristics, and possibly to the application.

1.2 The operation of the PAD depends on the values of the set of internal variables called PAD parameters. This set of parameters exists for each start-stop mode DTE independently. The current value of each PAD parameter defines the operational characteristics of its related function.

1.3 *Functions of the PAD*

1.3.1 Basic functions include:

- — assembly of characters into packets;
- — disassembly of the *user data* field of packets;
- — handling of virtual call set-up and clearing, resetting and interrupt procedures;
- — generation of service signals;
- — a mechanism for forwarding packets when the proper conditions exist, e.g., when a packet is full or an idle timer expires;
- — a mechanism for transmitting data characters, including start, stop and parity elements as appropriate, to the start-stop mode DTE;
- — a mechanism for handling a *break* signal from the start-stop mode DTE;
- — editing of *PAD command* signals;
- — a mechanism for setting and reading the current value of PAD parameters.

1.3.2 Optional functions include:

- — a mechanism for the selection of a standard profile;
- — automatic detection of data rate, code, parity and operational characteristics;
- — a mechanism for the remote DTE to request a virtual call between the start-stop mode DTE and another DTE.

1.4 *User selectable functions which may be provided by the PAD*

A number of packet-switched data network facilities may be available either on a subscription basis or on a per call basis, to start-stop mode DTEs as described in Recommendation X.2 for user classes of service 20-22. In addition, the following features may be available on a subscription basis:

- — selection of an initial profile;
- — modem type, speed, code and parity to be used by the PAD;
- — other operational characteristis of the DTE.

As defined in this Recommendation, parameters provide for functions which concern:

- — management of the procedure between the start-stop mode DTE and the PAD;
- — management of the assembly and disassembly of packets;
- — a number of additional functions related to the operational characteristics of the start-stop mode DTE.

The method for the control of these functions is specified in Recommendation X.28 for the start-stop mode DTE and in Recommendation X.29 for the packet mode DTE or for another PAD.

Table 1/X.3 shows details of the valid values and combination of values of PAD parameters standardized by CCITT. Other values and combinations of values are for further study.

1.4.1 *PAD recall using a character*

This function allows the start-stop mode DTE to initiate an escape from the *data transfer* state or the *connection in progress* state in order to send *PAD command* signals.

1.4.2 *Echo*

This function provides for characters received from the start-stop mode DTE to be transmitted back to the start-stop mode DTE as well as being interpreted by the PAD.

1.4.3 *Selection of data forwarding characters*

This function allows the selection of defined sets of character(s) received from the start-stop mode DTE to be recognized by the PAD as an indication to complete the assembly and forward a complete packet sequence as defined in Recommendation X.25.

1.4.4 *Selection of idle timer delay*

This function allows the selection of the duration of an interval between successive characters received from the start-stop mode DTE which, when exceeded, will cause the PAD to terminate the assembly of a packet and to forward it as defined in Recommendation X.25.

1.4.5 *Ancillary device control*

This function allows for flow control between the PAD and the start-stop mode DTE. The PAD indicates whether it is ready or not to accept characters from the start-stop mode DTE by transmitting special characters. These characters are those which in International Alphabet No. 5 (IA5) are used to switch an ancillary transmitting device on and off.

1.4.6 *Control of PAD service signals*

This function provides the start-stop mode DTE with the ability to decide whether or not and in what format *PAD service* signals are transmitted.

1.4.7 *Selection of operation of the PAD on receipt of the break signal*

This function allows the selection of the operation of the PAD after the receipt of a *break* signal from the start-stop mode DTE.

1.4.8 *Discard output*

This function provides for a PAD to discard the content of user sequences in packets upon request rather than disassembling and transmitting these to the start-stop mode DTE.

1.4.9 *Padding after carriage return*

This function provides for the automatic insertion by the PAD of padding characters in the character stream transmitted to the start-stop mode DTE after the occurrence of a carriage return character. This allows for the printing mechanism of the start-stop mode DTE to perform the carriage return function correctly.

1.4.10 *Line folding*

This function provides for the automatic insertion by the PAD of appropriate format effectors in the character stream transmitted to the start-stop mode DTE. The predetermined maximum number of graphic characters per line may be set.

1.4.11 *Flow control of the PAD by the start-stop mode DTE*

This function allows for flow control between the start-stop mode DTE and the PAD. The start-stop mode DTE indicates whether it is ready or not to accept characters from the PAD by transmitting special characters. These characters are those which in IA5 are used to switch an ancillary transmitting device on and off.

1.4.12 *Linefeed insertion after carriage return*

This function provides for the automatic insertion by the PAD of a linefeed character in the character stream to or from the start-stop mode DTE or after each of each carriage return character. This function applies only in the *data transfer* state.

1.4.13 *Padding after linefeed*

This function provides for the automatic insertion by the PAD of padding characters in the character stream transmitted to the start-stop DTE after the occurrence of a linefeed character. This allows for the printing mechanism of the start-stop mode DTE to perform the linefeed operation correctly. This function applies only in the *data transfer* state.

1.4.14 *Editing*

This function provides for character delete, line delete and line display editing capabilities in the *PAD command* state and the *data transfer* state for the start-stop mode DTE. During the *PAD command* state the editing function is always available.

1.4.15 *Editing PAD service signals*

This function provides the start-stop mode DTE with the ability to decide whether or not editing *PAD service* signals are transmitted and which format should be used.

1.4.16 *Echo mask*

When echo is enabled (§ 1.4.2), this function allows selected defined sets of character(s) received from the start-stop mode DTE to not be transmitted back to the start-stop mode DTE.

1.4.17 *Parity treatment*

This function allows the PAD to check parity in the data stream from the start-stop mode DTE and/or generate parity in the data stream to the start-stop mode DTE.

1.4.18 *Page wait*

This function allows the PAD to suspend transmission of additional characters to the start-stop mode DTE after a specified number of linefeed characters have been transmitted by the PAD.

2 Characteristics of PAD parameters

2.1   In this Recommendation parameters are identified by decimal reference numbers.

2.2   In this Recommendation the possible values of the parameters are represented by decimal numbers.

2.3   Specific procedures, described in Recommendations X.28 and X.29 are available for initializing, reading and changing the values of PAD parameters.

2.4 *Determination of the values of PAD parameters*

2.4.1 *Initial values of PAD parameters*

On initialization, the initial value of each PAD parameter is set according to a predetermined set of values called an *initial standard profile*. Table 1/X.28 gives details of the initial values of parameters for transparent and simple standard profiles which have been agreed by CCITT.

Networks may offer other standard profiles that provide different, predetermined sets of PAD parameter values.

2.4.2 *Current values of PAD parameters*

The current values of PAD parameters are the values resulting from possible modifications by the PAD, the start-stop mode DTE and/or the packet mode DTE (or remote PAD).

3 List of PAD parameters and possible values

Restrictions on the permissible relationships between the values of the various parameters is a subject for further study.

3.1 *PAD recall using a character*

Reference 1

The parameter will have the following selectable values:

not possible	— represented by decimal 0;
possible by character 1/0 (DLE)	— represented by decimal 1;
possible by graphic character defined by the user	— represented by decimal 32-126.

A graphic character, defined by the user to escape from the *data transfer* state and to recall the PAD, is the binary representation of the decimal value in accordance with Recommendation T.50.

3.2   *Echo*

Reference 2

The parameter will have the following selectable values:

no echo   — represented by decimal 0;

echo   — represented by decimal 1.

Note — If parameter 20 is implemented, the selection of the characters to be echoed is dependent on the value of parameter 20.

3.3   *Selection of data forwarding character(s)*

Reference 3

This parameter is represented by the following encoding of basic functions, each having a decimal value as shown below:

no data forwarding character   — represented by decimal 0;

alphanumeric characters (A-Z, a-z, 0-9)   — represented by decimal 1;

character CR   — represented by decimal 2;

characters ESC, BEL, ENQ, ACK   — represented by decimal 4;

characters DEL, CAN, DC2   — represented by decimal 8;

characters ETX, EOT   — represented by decimal 16;

characters HT, LF, VT, FF   — represented by decimal 32;

all other characters in columns 0 and 1 of IA5
not included in above   — represented by decimal 64.

Note — The decimal representation of individual values of this parameter allows coding to represent a single function or combination of functions, see Table 1/X.3.

3.4   *Selection of idle timer delay*

Reference 4

The parameter will have the following selectable values:

any number from 0 to 255   — represented by the respective decimal number.

The value 0 will indicate that no data forwarding on time-out is required; a value between 1 and 255 will indicate the value of the delay in twentieths of a second.

Note 1 — Some PAD implementations may not offer all possible values of idle timer delay within the selectable range. In such cases where the value selected is not available, the PAD will assume the next higher available value in the range.

Note 2 — The effect of the idle timer delay on data forwarding may be subject to flow control constraints.

3.5   *Ancillary device control*

Reference 5

The parameter will have the following selectable values:

no use of X-ON (DC1) and X-OFF (DC3)   — represented by decimal 0;

use of X-ON and X-OFF (data transfer)   — represented by decimal 1;

use of X-ON and X-OFF (data transfer and
command)   — represented by decimal 2.

3.6 Control of PAD service signals

Reference 6

The parameter is represented by the following encoding of basic functions, each having a decimal value as shown below:

no service signals are transmitted to the start-stop mode DTE	— represented by decimal 0;
service signals other than the *prompt PAD service* signal are transmitted in the standard format	— represented by decimal 1;
prompt PAD service signal is transmitted in the standard format	— represented by decimal 4.
PAD service signals are transmitted in a network-dependent format	— represented by decimal 8-15.

Note — The decimal representation of individual values of this parameter allows coding to represent a single function or combination of functions, see Table 1/X.3.

3.7 Selection of operation of PAD on receipt of break signal from the start-stop mode DTE

Reference 7

This parameter is represented by the following encoding of basic functions, each having a decimal value as shown below:

nothing	— represented by decimal 0;
send to packet mode DTE or other PAD an *interrupt* packet	— represented by decimal 1;
reset	— represented by decimal 2;
send to packet mode DTE or other PAD an *indication of break PAD* message	— represented by decimal 4;
escape from *data transfer* state	— represented by decimal 8;
discard output to start-stop mode DTE	— represented by decimal 16.

Note — The decimal representation of individual values of this parameter allows coding to represent a single function or combination of functions, see Table 1/X.3.

3.8 Discard output

Reference 8

The parameter will have the following selectable values:

normal data delivery to the start-stop mode DTE	— represented by decimal 0;
discard output to start-stop mode DTE	— represented by decimal 1.

3.9 Padding after carriage return

Reference 9

The parameter will have the following selectable values:

any number from 0 to 255	— represented by the respective decimal number.

A value between 0 and 255 will indicate the number of padding characters to be generated by the PAD after a carriage return character is transmitted to the start-stop mode DTE.

When parameter 9 is 0, there will be no padding except that *PAD service* signals will contain a number of padding characters according to the data rate of the start-stop mode DTE.

3.10 *Line folding*

The parameter will have the following selectable values:

no line folding	— represented by decimal 0;
any value between 1 and 255	— represented by the respective decimal number.

A value between 1 and 255 will indicate the number of graphic characters per line that will be transmitted by the PAD without inserting appropriate format effectors.

3.11 *Binary speed*

This parameter is a read-only parameter and cannot be changed by either of the DTEs. It enables the packet-mode DTE to access a characteristic of the start-stop mode DTE which is known by the PAD.

The parameter will have the following values:

50	bit/s	—	represented by decimal 10;
75	bit/s	—	represented by decimal 5;
100	bit/s	—	represented by decimal 9;
110	bit/s	—	represented by decimal 0;
134.5	bit/s	—	represented by decimal 1;
150	bit/s	—	represented by decimal 6;
200	bit/s	—	represented by decimal 8;
300	bit/s	—	represented by decimal 2;
600	bit/s	—	represented by decimal 4;
1 200	bit/s	—	represented by decimal 3;
1 800	bit/s	—	represented by decimal 7;
75/1 200	bit/s	—	represented by decimal 11;
2 400	bit/s	—	represented by decimal 12;
4 800	bit/s	—	represented by decimal 13;
9 600	bit/s	—	represented by decimal 14;
19 200	bit/s	—	represented by decimal 15;
48 000	bit/s	—	represented by decimal 16;
56 000	bit/s	—	represented by decimal 17;
64 000	bit/s	—	represented by decimal 18.

Note — The values implemented in individual PADs depend on the range of DTE data transmission rates which are supported. The allocation of decimal values to all known rates is to avoid revision of the Recommendation in the future.

3.12 *Flow control of the PAD by the start-stop mode DTE*

The parameter will have the following selectable values:

no use of X-ON (DC1) and X-OFF (DC3) for flow control	— represented by decimal 0;
use of X-ON and X-OFF for flow control	— represented by decimal 1.

3.13 *Linefeed insertion after carriage return*

Reference 13

This parameter is represented by the following encoding of basic functions, each having a decimal value as shown below:

no linefeed insertion	— represented by decimal 0;
insert linefeed after each carriage return in the data stream *to* the start-stop mode DTE	— represented by decimal 1;
insert linefeed after each carriage return in the data stream *from* the start-stop mode DTE	— represented by decimal 2;
insert a linefeed after each carriage return in the echo to the start-stop mode DTE	— represented by decimal 4.

Note 1 — The decimal representation of individual values of this parameter allows coding to represent a single function or combination of functions, see Table 1/X.3.

Note 2 — This function applies only in the *data transfer* state.

3.14 *Linefeed padding*

Reference 14

The parameter will have the following selectable values:

any number from 0 to 255 — represented by the respective decimal number.

A value between 0 and 255 will indicate the number of padding characters to be generated by the PAD after a linefeed character is transmitted to the start-stop mode DTE during the data transfer state.

3.15 *Editing*

Reference 15

The parameter will have the following selectable values:

no use of editing in the *data transfer* state	— represented by decimal 0;
use of editing in the *data transfer* state	— represented by decimal 1.

The use of value 1 suspends the following operations of the PAD:
a) Data forwarding on full packet until the editing buffer is full.
b) Data forwarding on idle timer period expiry.

Note — The value of parameter 4 remains unchanged.

3.16 *Character delete*

Reference 16

The parameter will have the following selectable values:

one character from IA5 — represented by decimal 0-127.

The character defined by the user for character delete is the binary representation of the decimal value in accordance with Recommendation T.50.

3.17 *Line delete*

Reference 17

The parameter will have the following selectable values:

one character from IA5 — represented by 0-127.

The character defined by the user for line delete is the binary representation of the decimal value in accordance with Recommendation T.50.

3.18 *Line display*

Reference 18

The parameter will have the following selectable values:

one character from IA5   — represented by 0-127.

The character defined by the user for line display is the binary representation of the decimal value in accordance with Recommendation T.50.

3.19 *Editing PAD service signals*

Reference 19

The parameter will have the following selectable values:

No editing *PAD service* signals	— represented by decimal 0;
editing *PAD service* signals for printing terminals	— represented by decimal 1;
Editing *PAD service* signals for display terminals	— represented by decimal 2;
editing *PAD service* signals using one character from the range of IA5	— represented by decimal 8 and 32-126.

Note — This parameter does not apply if the value of parameter 6 is set to 0.

3.20 *Echo mask*

Reference 20

This parameter is represented by the following encoding of basic functions, each having a decimal value as shown below:

no echo mask (all characters echoed)	— represented by decimal 0;
no echo of character CR	— represented by decimal 1;
no echo of character LF	— represented by decimal 2;
no echo of characters VT, HT, FF	— represented by decimal 4;
no echo of characters BEL, BS	— represented by decimal 8;
no echo of characters ESC, ENQ	— represented by decimal 16;
no echo of characters ACK, NAK, STX, SOH, EOT, ETB, ETX	— represented by decimal 32;
no echo of editing characters as designated by parameters 16, 17 and 18	— represented by decimal 64;
no echo of all other characters in columns 0 and 1 of IA5 not mentioned above, and the character DEL·	— represented by decimal 128.

Note 1 — The decimal representation of individual values of this parameter allows coding to represent a single function or combination of functions (see Table 1/X.3).

Note 2 — If parameter 5, 12 or 22 is set to a non-zero value, then X-ON and X-OFF are not echoed.

Note 3 — The PAD recall character specified by the value of parameter 1 is not echoed.

Note 4 — A character need only be specified by a single value of parameter 20 in order for it not to be echoed.

Note 5 — This parameter applies only when parameter 2 is set to 1.

3.21 *Parity treatment*

Reference 21

This parameter will have the following selectable values:

no parity checking or generation   — represented by decimal 0;

parity checking   — represented by decimal 1;

parity generation   — represented by decimal 2.

Note 1 — The decimal representation of individual values of this parameter allows coding to represent a single function or a combination of functions (see Table 1/X.3).

3.22 *Page wait*

Reference 22

This parameter will have the following selectable values:

page wait disabled   — represented by decimal 0;

page wait condition after n linefeed characters are sent by the PAD to the start-stop mode DTE   — represented by decimal 1-255.

Possible values and combination of values of PAD parameters

(see Note 1)

Parameter reference number	Parameter description	Selectable possible values		PAD parameter meaning	Remarks
		Mandatory	Optional (see Note 2)		
1	PAD recall using a character (E)	0		Not possible	
		1		Character DLE	
			32 to 126	Possible; using one graphic character defined by user	
2	Echo (E)	0		No echo	
		1		Echo	
3	Selection of data forwarding character(s) (E)	0		No *data forwarding* character(s)	
		2		Character CR	
			6	Characters CR, ESC, BEL, ENQ, ACK	Value formed by combination (2+4)
			18	Characters CR, EOT, ETX	Value formed by combination (2+16)
		126		All characters in column 0 and 1 and character DEL	Value formed by combination (2+4+8+16 +32+64)
4	Selection of idle timer delay (E)	0 20 255	1 to 19 21 to 254	Value of idle timer in twentieths of a second	(Note 3)
5	Ancillary device control (E)	0		No use of X-ON (DC1) and X-OFF (DC3)	
		1		Use of X-ON and X-OFF (data transfer)	
			2	Use of X-ON and X-OFF (data transfer and command)	
6	Control of *PAD service* signals (E)	0		No *PAD service* signals are transmitted to the start-stop mode DTE	
		1		*PAD service* signals are transmitted in the standard format	
			5	*PAD service* signals and the *prompt PAD service* signal are transmitted in the standard format	Value formed by combination (1+4)
			8 to 15	*PAD service* signals are transmitted in a network dependent format	

Parameter reference number	Parameter description	Selectable possible values		PAD parameter meaning	Remarks
		Mandatory	Optional (see Note 2)		
7	Selection of operation of the PAD on receipt of break signal from the start-stop mode DTE (E)	0		Nothing	
			1	Interrupt	
		2		Reset	
			5	Interrupt and indication of break	Value formed by combination (1+4)
		8		Escape from *data transfer* state	
		21		Discard output, interrupt and indication of break	Value formed by combination (1+4+16)
8	Discard output (E)	0		Normal data delivery	
		1		Discard output	
9	Padding after carriage return (CR) (E)	0		No padding after CR (see Note 4)	
		1 to 7	8 to 255	Number of padding characters inserted after CR	
10	Line folding (E)	0		No line folding	
		1 to 255		Number of graphic characters per line	
11 (read only)	Binary speed of start-stop mode DTE (E)	0		110 bit/s	The values implemented in individual PADs depend on the range of DTE data transmission rates which are supported. The allocation of decimal values to all known rates is to avoid revision of the Recommendation in the future
			1	134.5 bit/s	
		2		300 bit/s	
			3	1 200 bit/s	
			4	600 bit/s	
			5	75 bit/s	
			6	150 bit/s	
			7	1 800 bit/s	
			8	200 bit/s	
			9	100 bit/s	
			10	50 bit/s	
			11	75/1 200 bit/s	
			12	2 400 bit/s	
			13	4 800 bit/s	
			14	9 600 bit/s	
			15	19 200 bit/s	
			16	48 000 bit/s	
			17	56 000 bit/s	
			18	64 000 bit/s	
12	Flow control of the PAD (E)	0		No use of X-ON (DC1) and X-OFF (DC3) for flow control	
		1		Use of X-ON (DC1) and X-OFF (DC3) for flow control	

Parameter reference number	Parameter description	Selectable possible values		PAD parameter meaning	Remarks
		Mandatory	Optional (see Note 2)		
13	Linefeed insertion after carriage return (A)	0		No linefeed insertion	
		1		Insert linefeed after transmission of CR to the start-stop mode DTE	
		4		Insert linefeed after echo of CR to start-stop mode DTE	
		5		Insert linefeed after transmission to the start-stop mode DTE and after echo of CR	Combination (1 + 4)
		6		Insert linefeed in data stream after CR from the start-stop mode DTE and after echo of a CR to the start-stop mode DTE	Combination (2 + 4)
		7		Insert linefeed in the data stream to and from the start-stop mode DTE and after echo of a CR to the start-stop mode DTE	Combination (1 + 2 + 4) *Note* — Applies only to *data transfer* state
14	Padding after linefeed (A)	0		No padding after linefeed	*Note* — Applies only to *data transfer* state
		1 to 7	8 to 255	Number of padding characters inserted after linefeed	
15 (see Note 5)	Editing (A)	0		No use of editing in the *data transfer* state	
		1		Use of editing in the *data transfer* state	
16 (see Note 5)	Character delete (A)		0 to 126	One character from IA5	
		127		Character 7/15 (DEL)	
17 (see Note 5)	Line delete (A)		0 to 23	One character from range of IA5	
		24		Character 1/8 (CAN)	
			25 to 127	One character from range of IA5	
18 (see Note 5)	Line display (A)		0 to 17	One character from IA5	
		18		Character 1/2 (DC2)	
			19 to 127	One character from IA5	

Parameter reference number	Parameter description	Selectable possible values		PAD parameter meaning	Remarks
		Mandatory	Optional (see Note 2)		
19 (see Note 5)	Editing PAD service signals (A)	1	0	No editing *PAD service* signals	
				Editing *PAD service* signals for printing terminals	
			2	Editing *PAD service* signals for display terminals	
			8 32 to 126	Editing *PAD service* signals using one character from the range of IA5	
20 (see Notes 6 and 7)	Echo mask (A)	0		No echo mask (all characters echoed)	
			1	No echo of CR	
			2	No echo of LF	
			4	No echo of VT, HT, FF	
			8	No echo of BEL, BS	
			16	No echo of ESC, ENQ	
			32	No echo of ACK, NAK, STX, SOH, EOT, ETB, ETX	Values may be formed by combination of basic values
			64	No echo of editing characters as designated by Parameters 16, 17, 18	
			128	No echo of all other characters in columns 0 and 1 not mentioned above and DEL	
21	Parity treatment (A)	0		No parity checking or generation	
			1	Parity checking	
			2	Parity generation	
			3	Parity checking and parity generation	Value formed by combination (1+2)
22	Page wait (A)	0 23	1 to 22 24 to 255	Page wait disabled. Number of line feed characters considered by the PAD for the page wait function	

E: an essential parameter to be made available internationally.
A: an additional parameter which may be available on certain data networks and may also be available internationally.

Note 1 — Other values and possible combination of values are for further study.

Note 2 — These parameter values provide additional user facilities which are not necessarily provided in all PADs.

Note 3 — Some PAD implementations may not offer all possible values of idle timer delay within the selectable range. In such cases where the value selected is not available, the PAD will assume the next higher value available.

Note 4 — There is no padding after CR except that *PAD service* signals will contain a number of padding characters according to the data signalling rate of the start-stop mode DTE.

Note 5 — When parameter 15 is implemented, the values of parameters 16, 17, 18 and 19 are either default values or are selectable from the optional range shown. The editing function is provided during the *PAD command* state whether parameter 15 is implemented or not. If parameters 16, 17, 18 and 19 are implemented, the editing characters and editing *PAD service* signals during the *PAD command* state are defined by the appropriate values of these parameters. If parameters 16, 17, 18 and 19 are not implemented, the default values for the functions of these parameters are applicable to the *PAD command* state.

Note 6 — This parameter does not apply if parameter 2 is set to zero.

Note 7 — If parameter 5, 12 or 22 is set to a nonzero value, then the X-ON and X-OFF characters are not echoed.

APPENDIX I

(to Recommendation X.3)

List of terms

The following terms are contained in this Recommendation. References to definitions, implicit or explicit, are included where appropriate and where available.

A

Ancillary device control
cont. in X.3; impl. def. in X.3

Assembly of characters
cont. in X.3; impl. def. in X.3

B

Basic functions
cont. in X.3; impl. def. in X.3

Break signal
cont. in X.3; impl. def. in X.3

C

Character delete
cont. in X.3; impl. def. in X.3

Control information
cont. in X.3; impl. def. in X.3

Control of PAD service signals
cont. in X.3; impl. def. in X.3

D

Disassembly of packets
cont. in X.3; impl. def. in X.3

Discard output
cont. in X.3; impl. def. in X.3

E

Echo
cont. in X.3; impl. def. in X.3

Echo mask
cont. in X.3; impl. def. in X.3

Editing
cont. in X.3; impl. def. in X.3

F

Flow control of the PAD
cont. in X.3; impl. def. in X.3

I

Initial profile
cont. in X.3; impl. def. in X.3

L

Line delete
cont. in X.3; impl. def. in X.3

Line display
cont. in X.3; impl. def. in X.3

Line folding
cont. in X.3; impl. def. in X.3

Linefeed insertion after carriage return
cont. in X.3; impl. def. in X.3

P

Packet assembly/disassembly
cont. in X.3; impl. def. in X.3

Packet-mode DTE
cont. in X.3; impl. def. in X.3

PAD command
cont. in X.3; impl. def. in X.3

PAD parameters
cont. in X.3; impl. def. in X.3

PAD recall
cont. in X.3; impl. def. in X.3

Padding after carriage return
cont. in X.3; impl. def. in X.3

Padding after linefeed
cont. in X.3; impl. def. in X.3

Page wait
cont. in X.3; impl. def. in X.3

Parity treatment
cont. in X.3; impl. def. in X.3

S

Selection of data forwarding character(s)
cont. in X.3; impl. def. in X.3

Selection of idle timer delay
cont. in X.3; impl. def. in X.3

Standard profiles
cont. in X.3; impl. def. in X.3

Start-stop mode DTE
cont. in X.3; impl. def. in X.3

U

User information
cont. in X.3; impl. def. in X.3

User selectable functions
cont. in X.3; impl. def. in X.3

GENERAL STRUCTURE OF SIGNALS OF INTERNATIONAL ALPHABET No. 5 CODE
FOR DATA TRANSMISSION OVER PUBLIC DATA NETWORKS[1]

(Geneva, 1976; amended at Geneva, 1980)

The CCITT,

I   *considering, firstly,*

the agreement between the International Organization for Standardization (ISO) and the CCITT on the main characteristics of a seven-unit alphabet (International Alphabet No. 5) to be used for data transmission and for telecommunications requirements that cannot be met by the existing five-unit International Telegraph Alphabet No. 2;

the interest, both to the users and to the telecommunication services, of an agreement concerning the chronological order of transmission of bits in serial working;

declares the view

that the agreed rank number of the unit in the alphabetical table of combinations should correspond to the chronological order of transmission in serial working on telecommunication circuits;

that, when this rank in the combination represents the order of the bit in binary numbering, the bits should be transmitted in serial working with the low order bit first;

that the numerical meaning corresponding to each information unit considered in isolation is that of the digit:

0 for a unit corresponding to condition A (travail = space), and

1 for a unit corresponding to condition Z (repos = mark),

in accordance with the definitions of these conditions for a two-condition transmission system;

II   *considering, moreover,*

that it is often desirable, in data and messages transmission, to add an extra "parity" unit to allow for the detection of errors in received signals;

the possibility offered by this addition for the detection of faults in terminal equipment;

the need to reserve the possibility of making this addition during the transmission itself, after the seven information units proper have been sent;

declares the view

that signals of International Alphabet No. 5 code for data and messages transmission should in general include an additional "parity" unit;

that the rank of this unit and, hence, the chronological order of the transmission in serial working should be the eighth of the combination thus completed;

III   *considering*

that, in start-stop systems working with electromechanical equipment, the margin of such equipment and the reliability of the connection are considerably increased by the use of a stop element corresponding to the duration of two-unit intervals of the modulation;

that for start-stop systems using International Alphabet No. 5 at modulation rates of 200 and 300 bauds, Recommendations X.1 and S.31 specify that transmit devices should use a stop element lasting at least two units;

that the previously expressed preference for a two-unit stop element arises from a transmission point of view where anisochronous public data networks are concerned;

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[1]   See Recommendation V.4 for data transmission over public telephone networks.

declares the view

that in start-stop systems using combinations of International Alphabet No. 5 normally followed by a parity unit, the first information unit of the transmitted combination should be preceded by a start element corresponding to condition A (space);

that the duration of this start element should be a one-unit interval for the modulation rate under consideration, at transmitter output;

that the combination of seven information units, normally completed by its parity unit, should be followed by a stop element corresponding to condition Z (mark);

that for public anisochronous data networks, data terminal equipment using International Alphabet No. 5 should comply with Recommendations X.1 and S.31 and use a stop element lasting at least two units;

that the start-stop receivers should be capable of correctly receiving start-stop signals from a source which appears to have a nominal cycle of 10 units (i.e., with a nominal one-unit stop element). However, for certain electromechanical equipment the receivers may only be capable of correctly receiving signals when the stop element is not reduced below one unit (even in the presence of distortion);

IV   *considering, finally,*

that the direction of the parity unit can only be that of the even parity on the perforated tapes, particularly owing to the possibility of deletion (combination 7/15 of the alphabet) which causes a hole to appear in all tracks;

that, on the other hand, the odd parity is considered essential in the equipment which depends on transitions in the signals to maintain synchronism [in cases where combination 1/6 (SYNC) of the alphabet does not permit of an economical solution];

declares the view

that the parity unit of the signal should correspond to the even parity in links or connections operated on the principle of the start-stop system;

that this parity should be odd on links or connections using end-to-end synchronous operation;

that arrangements should be made when necessary to reverse the direction of the parity unit at the input and output of the synchronous equipment connected either to apparatus working on the start-stop principle or receiving characters on perforated tape;

that the detection of a character out-of-parity may be represented by:

a)   a reverse question mark graphic character or a representation of the capital letter SB (see ISO 2047) provided that this letter occupies a single character position on a screen or printer, and which could have been entered by a single key stroke. It is recognized that it may be difficult to achieve a legible "SB" character from some matrix printers or displays where the characters are printed; or

b)   a recording of the 1/10 (SUB) character in the tape or other storage medium, where provided.

Where a SUB character occurs in a received transmisson, or is presented to a DTE via a storage medium, e.g. paper tape, then the reaction should be as in a) and b) above.

CATEGORIES OF ACCESS FOR DATA TERMINAL EQUIPMENT [DTE] TO PUBLIC DATA TRANSMISSION SERVICES PROVIDED BY PDNs AND/OR ISDNs THROUGH TERMINAL ADAPTORS

(Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that Recommendation X.1 defines the international user classes of service in public data networks (PDNs) and ISDN;

(b) that Recommendation X.2 defines the international user services and facilities in PDNs;

(c) that Recommendation X.3 defines the Packet Assembly/Disassembly facility (PAD) in packet switched public data networks;

(d) that Recommendation I.411 defines the reference configurations for access to ISDN services, including Terminal Adaptor (TA) functional grouping;

(e) that Recommendations I.200, X.30 (I.461) and X.31 (I.462) define the circuit switched and packet switched data transmission services available from ISDN through Terminal Adaptors;

(f) the desirability for the users to have defined the various possibilities and requirements for accessing the different public data transmission services,

unanimously declares the view

that categories of access for data terminal equipment (DTE) to the data transmission services provided by PDNs and by ISDNs through Terminal Adaptors should be as defined in this Recommendation.

1 Scope

This Recommendation defines the different categories of access for data terminal equipment to the different data transmission services provided by public data networks (PDNs) as defined in Recommendation X.2 and by ISDNs through Terminal Adaptors as defined in Recommendations I.200, X.30 (I.461) and X.31 (I.462), namely:

i) circuit switched data transmission services;

ii) packet switched data transmission services;

iii) leased circuit data transmission services.

The categories of access described in this Recommendation take into account direct connections (see Note) to public data networks and ISDNs and the various access cases where interworking with other public networks is involved. Access to the packet switched data transmission service via the PAD function as defined in Recommendation X.3 is also covered in this Recommendation.

Note — Direct connections may be provided by means of leased circuits or by dedicated access circuits.

2 General

Access for data terminal equipment to data transmission services may be achieved by either of the following (see Note):

a) by direct connection of the DTE to the public data network or ISDNs;

b) or by switched connection of the DTE to a PDN via an intermediate public network of another type (including a PDN, PSTN or ISDN);

c) or by switched connection of the DTE to an ISDN through a Terminal Adaptor via an intermediate public network of another type.

For example, packet mode terminals may access the public packet switched data transmission service, in user classes of service 8 to 11, either directly or via a switched connection. The switched connection will be established using a circuit switched data network or a public switched telephone network. In both switched cases an interworking function will be required to access the packet switched data transmission service.

Note — It is not mandatory for Administrations to provide all the categories of access contained in this Recommendation.

3 Categories of access

§ 3.1 specifies the categories of access to the data transmission services provided by PDNs for the direct connection case.

§ 3.2 specifies the categories of access to the data transmission services provided by PDNs for the switched connection case.

§ 3.3 specifies the categories of access to the data transmission services provided by ISDNs through Terminal Adaptors for the direct connection case.

§ 3.4 specifies the categories of access to the data transmission services provided by ISDNs through Terminal Adaptors for the switched connection case.

3.1 *Direct connection to data transmission services provided by public data networks*

TABLE 1/X.10

**Start-stop direct connection to a circuit switched
data transmission service**

(see Notes 1 and 2)

Category of access	Data signalling rate	DTE/DCE interface requirements
A1 A2	50 to 200 bit/s 300 bit/s	See Recommendations X.20 and X.20 *bis*

TABLE 2/X.10

**Synchronous direct connection to a circuit switched
data transmission service**

(see Note 1)

Category of access	Data signalling rate	DTE/DCE interface requirements
B1	600 bit/s	
B2	2 400 bit/s	
B3	4 800 bit/s	See Recommendations X.21 and X.21 *bis*
B4	9 600 bit/s	
B5	48 000 bit/s	

TABLE 3/X.10

**Start-stop direct connection to a packet switched
data transmission service**

(see Notes 1 and 3)

Category of access	Data signalling rate	DTE/DCE interface requirements
C1	110 bit/s	
C2	200 bit/s	
C3	300 bit/s	See Recommendation X.28
C4	1 200 bit/s	
C5	75/1 200 bit/s	

TABLE 4/X.10

**Synchronous direct connection to a packet switched
data transmission service**

(see Note 1)

Category of access	Data signalling rate	DTE/DCE interface requirements
D1	2 400 bit/s	
D2	4 800 bit/s	
D3	9 600 bit/s	See Recommendation X.25
D4	48 000 bit/s	

TABLE 5/X.10

**Start-stop direct connection to a leased circuit
data transmission service**

(see Note 2)

Category of access	Data signalling rate	DTE/DCE interface requirements
E1	50 to 200 bit/s	See Recommendations X.20 and X.20 *bis*
E2	300 bit/s	

TABLE 6/X.10

**Synchronous direct connection to a leased circuit
data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements
F1	600 bit/s	
F2	2 400 bit/s	
F3	4 800 bit/s	See Recommendations X.21 and X.21 *bis*
F4	9 600 bit/s	
F5	48 000 bit/s	

3.2 Switched connection to data transmission services provided by public data networks

TABLE 7/X.10

**Start-stop switched connection by means of the PSTN
to a circuit switched data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements
G1	300 bit/s	See Note 4

TABLE 8/X.10

**Start-stop switched connection by means of an ISDN B channel
to a circuit switched data transmission service**

For further study.

TABLE 9/X.10

**Synchronous switched connection by means of the PSTN
to a circuit switched data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements
I1	600 bit/s	See Note 4
I2	2 400 bit/s	
I3	4 800 bit/s	
I4	9 600 bit/s	

TABLE 10/X.10

**Synchronous switched connection by means of an ISDN B channel
to a circuit switched data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements at reference point R
J1	600 bit/s	See Recomendations X.21, X.21 *bis* et X.30 (minimum integration scenario)
J2	2 400 bit/s	
J3	4 800 bit/s	
J4	9 600 bit/s	
J5	48 000 bit/s	

TABLE 11/X.10

**Start-stop switched connection by means of a CSPDN
to a packet switched data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements
K1	300 bit/s	See Recommendation X.28

TABLE 12/X.10

**Start-stop switched connection by means of the PSTN
to a packet switched data transmission service**

(see Note 3)

Category of access	Data signalling rate	DTE/DCE interface requirements
L1	110 bit/s	See Recommendation X.28
L2	200 bit/s	
L3	300 bit/s	
L4	1 200 bit/s	
L5	75/1 200 bit/s	

TABLE 13/X.10

**Start-stop switched conneciton by means of an ISDN B channel
to a packet switched data transmission service**

For further study.

TABLE 14/X.10

**Synchronous switched connection by means of a CSPDN
to a packet switched data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements
O1	2 400 bit/s	See Recommendation X.32
O2	4 800 bit/s	
O3	9 600 bit/s	
O4	48 000 bit/s	

TABLE 15/X.10

**Synchronous switched connection by means of the PSTN
to a packet switched data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements
P1	1 200 bit/s	See Recommendation X.32
P2	2 400 bit/s	
P3	4 800 bit/s	
P4	9 600 bit/s	

TABLE 16/X.10

**Synchronous switched access by means of an ISDN B channel
to a packet switched data transmission service**

(see Note 5)

Category of access	Data signalling rate	DTE/DCE interface requirements at reference point R
Q1 Q2 Q3 Q4	2 400 bit/s 4 800 bit/s 9 600 bit/s 48 000 bit/s	See Recommendations X.25 and X.31 (minimum integration scenario)

3.3   *Direct connection to data transmission services provided by ISDNs through Terminal Adaptors* (see Note 6)

TABLE 17/X.10

**Synchronous direct connection to a circuit switched
data transmission service**

Category of access	Data signalling rate	DTE/DCE interface requirements at reference point R
S1 S2 S3 S4 S5 S6	600 bit/s 2 400 bit/s 4 800 bit/s 9 600 bit/s 48 000 bit/s 64 000 bit/s	See Recommendations X.21, X.21 *bis* and X.30 (maximum integration scenario)

TABLE 18/X.10

**Synchronous direct connection via the B channel
to a packet switched data transmission service**

(see Note 7)

Category of access	Data signalling rate	DTE/DCE interface requirements at reference point R
T1 T2 T3 T4 T5	2 400 bit/s 4 800 bit/s 9 600 bit/s 48 000 bit/s 64 000 bit/s	See Recommendations X.25 and X.31 (maximum integration scenario)

TABLE 19/X.10

**Synchronous direct connection via the D channel
to a packet switched data transmission service**

(see Note 7)

Category of access	Data signalling rate	DTE/DCE interface requirements at reference point R
U1	2 400 bit/s	
U2	4 800 bit/s	
U3	9 600 bit/s	
U4	48 000 bit/s (see Note 8)	See Recommendations X.25 and X.31
U5	64 000 bit/s (see Note 8)	

3.4 *Switched connection to data transmission services provided by ISDNs through Terminal Adaptors* (see Note 6)

TABLE 20/X.10

**Start-stop switched connection by means of the PSTN
to a packet switched data transmission service**

For further study.

TABLE 21/X.10

**Synchronous switched connection by means of a CSPDN
to a packet switched data transmission service**

For further study.

TABLE 22/X.10

**Synchronous switched connection by means of the PSTN
to a packet switched data transmission service**

For further study.

TABLE 23/X.10

Synchronous switched connection by means of an ISDN B channel to a packet switched data transmission service

(see Notes 5 and 7)

Category of access	Data signalling rate	DTE/DCE interface requirements at reference point R
Y1	2 400 bit/s	
Y2	4 800 bit/s	See Recommendations X.25 and X.31
Y3	9 600 bit/s	(maximum integration scenario)
Y4	48 000 bit/s	
Y5	64 000 bit/s	

Note 1 — Direct connections may be provided by means of leased circuits or by dedicated access circuits.

Note 2 — Some Administrations are planning to offer the categories of access of 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s and 9600 bit/s.

Note 3 — Some Administrations may offer higher speeds.

Note 4 — The relevant series X Recommendation(s) is (are) for further study.

Note 5 — Alignment of Recommendations X.31 and X.32 is for further study.

Note 6 — Implications of channel types besides B and D require further study.

Note 7 — Access at a data signalling rate of 1200 bit/s is for further study.

Note 8 — For 64 kbit/s D channel only.

List of terms

The following terms are contained in this Recommendation. References to definitions, implicit or explicit, are included where appropriate and where available.

C

Category of access
cont. in X.10; expl. def. in X.15

Circuit switched data transmission service
cont. in X.10; expl. def. in X.15

CSPDN (circuit switched public data network)
cont. in X.10

D

Data signalling rate
cont. in X.10; expl. def. in X.15

Data terminal equipment
cont. in X.10; expl. def. in X.15

Data transmission service
cont. in X.10; impl. def. in X.2; expl. def. in X.15

Direct connection
cont. in X.10

DTE/DCE interface
cont. in X.10; expl. def. in X.15

I

Interworking
cont. in X.10

ISDN (integrated services digital networks)
cont. in X.10

L

Leased circuit data transmission service
cont. in X.10; expl. def. in X.15

M

Maximum integration scenario
cont. in X.10; impl. def. in X.30, X.31

Minimum integration scenario
cont. in X.10; impl. def. in X.30, X.31

P

Packet assembly/disassembly
cont. in X.10; expl. def. in X.15

Packet switched data transmission service
cont. in X.10; expl. def. in X.15

PSTN (public switched telephone network)
cont. in X.10

Public data network
cont. in X.10; expl. def. in X.15

R

Reference point R
cont. in X.10; impl. def. in I.411

S

Switched connection
cont. in X.10

T

TE1: terminal equipment 1
cont. in X.10; impl. def. in I.411

Terminal adaptor
cont. in X.10; impl. def. in X.31

Recommendation X.15

DEFINITIONS OF TERMS CONCERNING PUBLIC DATA NETWORKS

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

Note 1 — In the preparation of this Recommendation the following was taken into account:
— the major terms available for reference purposes,
— the avoidance of repetition of definitions available in certain Recommendations,
— the identification of the source of terms in the Series X Recommendations.

Note 2 — § 1 contains definitions of terms which are of general interest.

Note 3 — § 2 contains an alphabetical list of terms used and defined in Recommendations of the Series X and identifies the Recommendations in which they are used and defined.

Note 4 — It should be noted that there also exist a large number of definitions in force concerning public data networks which have been published in the *List of essential telecommunication terms*, Part I (including its two Supplements); *Green Book*, Volume VIII and *Orange Book*, Volume VIII.2.

1   Definitions of terms

1.1   access barred

> *F: accès interdit*
>
> *S: acceso prohibido*

The state in which the calling DTE is not permitted to make a call to the DTE identified by the *selection* signals.

1.2   broadcasting

> *F: service complémentaire de diffusion*
>
> *S: difusión*

This optional user facility provides the user with the capability to establish a connection between $n + 1$ DTEs. One DTE, called the master DTE, transmits towards the n other tributary DTEs.

1.3   call collision at the DTE/DCE interface

> *F: collision d'appel à l'interface ETTD/ETCD*
>
> *S: colisión de llamadas en el interfaz ETD/ETCD*

The occurrence of the simultaneous transmission of a *call request* signal from the DTE and an *incoming call* signal from the DCE so that neither equipment receives the expected responses.

1.4   call establishment

> *F: établissement de l'appel*
>
> *S: establecimiento de la comunicación*

The sequence of events for the establishment of a data connection.

1.5   call identifier

> *F: identificateur de communication*
>
> *S: identificador de la llamada*

A network utility which is an identifying name assigned by the originating network for each established or partially established virtual call and, when used in conjunction with the calling DTE address, uniquely identifies the virtual call over a period of time.

1.6 call progress signal

    F: signal de progression de l'appel

    S: señal de progresión de la llamada

A *call control* signal transmitted from the DCE to the calling DTE to inform it about the progression of a call or the reason why the connection could not be established or any other network condition.

Additionally for packet services, a control signal:

- for the virtual call service to inform the calling and called DTEs the reason why the call has been cleared;
- for the permanent virtual circuit service, to inform the DTEs the reason why the permanent virtual circuit has been reset;
- for the datagram service, to inform the source DTE about the delivery or nondelivery of a specific datagram, or general operation of the DTE/DCE datagram interface or service.

Note 1 — Definitions of specific *call progress* signals can be found in Recommendation X.96.

Note 2 — The term *service signal* can be considered as a synonym for the term *call progress signal.*

1.7 call request signal

    F: signal de demande d'appel

    S: señal de petición de llamada

A signal in the call establishment phase which alerts the DCE that the DTE wishes to make a call.

1.8 category of access

    F: catégorie d'accès

    S: categoría de acceso

A method by which a data terminal equipment may gain access to the public data transmission services in which data signalling rate and DTE/DCE interface requirements are standardized. Defined methods include direct connection to public data networks or integrated services digital networks and a variety of switched connections to those networks via other public networks.

1.9 centralized multipoint

    F: service complémentaire de liaisons multipoints centralisées

    S: multipunto centralizado

An optional user facility which enables a central DTE to transmit data simultaneously to two or more remote DTEs, and to receive data transmitted by the remote DTEs one at a time. Data transmitted by a remote DTE is not delivered to other remote DTEs.

1.10 character alignment

    F: alignement de caractères

    S: alineación de caracteres

The identification of groups of contiguous bits which constitute characters.

1.11 circuit switched data transmission service

    F: service de transmission de données à commutation de circuits

    S: servicio de transmisión de datos con conmutación de circuitos

A service requiring the establishment of a circuit switched data connection before data can be transferred between data terminal equipment.

1.12   data circuit-terminating equipment (*DCE*)

F: équipement de terminaison de circuit de données (ETCD)

S: equipo de terminación del circuito de datos (ETCD)

In a data station, the equipment that provides the signal conversion and coding between the data terminal equipment (DTE) and the line.

Note 1 — See Figure 1/X.15.

Note 2 — The DCE may be separate equipment or an integral part of the DTE or of intermediate equipment.

Note 3 — A DCE may perform other functions that are usually performed at the network end of the line.
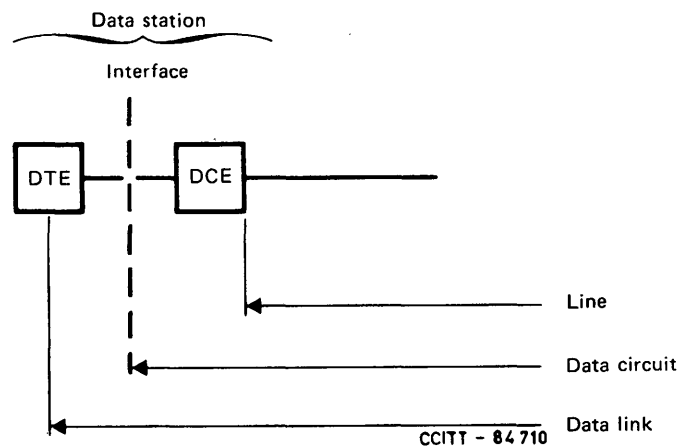
FIGURE 1/X.15

Components of a data link

1.13   data communication

F: communication de données

S: comunicación de datos

Transfer of information between functional units by means of data transmission according to a protocol.

1.14   data communication networks

F: réseaux de communications de données

S: redes de comunicación de datos

Data networks established and operated either by Administrations, or by private organizations.

1.15 data signalling rate

F: débit binaire

S: velocidad binaria; velocidad de senalización de datos

The aggregate signalling rate in the transmission path of a data transmission system, expressed in normalized form in binary digits (bits) per second.

It is given by:

$$\sum_{i=1}^{m} \frac{1}{T_i} \log_2 n_i$$

where m is the number of parallel channels, T_i is the minimum interval for the i-th channel expressed in seconds, n_i is the number of significant conditions of the modulation in the i-th channel.

Note – For a single channel (serial transmission) it reduces to $1/T \log_2 n$; with a two-condition modulation ($n = 2$), it is $1/T$.

For a parallel transmission with equal minimum intervals and equal number of significant conditions on each channel, the summation is $m(1/T) \log_2 n$ (m/T in case of a two-condition modulation).

1.16 data sink

F: puits de données

S: sumidero de datos

The functional unit that accepts transmitted data.

1.17 data source

F: source de données

S: fuente de datos

The functional unit that originates data for transmission.

1.18 data station

F: station de données

S: estación de datos

The data terminal equipment (DTE), the data circuit terminating equipment (DCE), and any intermediate equipment.

Note 1 – See Figure 1/X.15.

Note 2 – The DTE may be connected directly to a data processing system, or may be part of it.

1.19 data terminal equipment (DTE)

F: équipement terminal de traitement de données (ETTD)

S: equipo terminal de datos (ETD)

That part of a data station that serves as a data source, a data sink, or both.

Note – See Figure 1/X.15.

1.20 data transfer

F: transfert de données

S: transferencia de datos

The result of the transmission of data signals from a data source to data sink.

1.21 data transfer rate

F: rapidité de transfert de données

S: velocidad de transferencia de datos

The average number of bits, characters or blocks per unit time passing between corresponding equipments in a data transmission system.

Note 1 — It is expressed in terms of bits, characters or blocks per second, minute or hour.

Note 2 — Corresponding equipments should be indicated: modems or intermediate equipment or source and sink.

1.22 data transmission

F: transmission de données

S: transmisión de datos

The conveying of data from one place for reception elsewhere by telecommunication means.

1.23 decentralized multipoint

F: service complémentaire de liaisons, multipoints décentralisées

S: multipunto descentralizado

This optional user facility provides the user with the capability to establish a connection between $n + 1$ DTEs. Each DTE can transmit towards the n other DTEs. Each DTE can receive from all the other DTEs.

1.24 diagnostic code in Recommendation X.25

F: code de diagnostic dans la Recommandation X.25

S: código de diagnóstico de la Recomendación X.25

A unique combination of symbols, such as the CCITT International Alphabet No. 5, binary or hexadecimal notation, used to convey information between the DTE and the DCE for the purpose of indicating errors, failures, or inherent incompatibilities of a DTE with the network or with another DTE.

1.25 DTE busy

F: ETTD occupé

S: ETD ocupado

Status of DTE which is unavailable because it cannot accept an additional call.

1.26 DTE controlled not ready

F: ETTD non prêt commandé

S: ETD no preparado controlado

Indicates that, although the DTE is operational, it is temporarily unable to accept incoming calls.

1.27 DTE uncontrolled not ready

F: ETTD non prêt automatique

S: ETD no preparado no controlado

Indicates that the DTE is unable to accept incoming calls, generally because of abnormal operating conditions.

1.28 DTE/DCE interface

F: interface ETTD/ETCD

S: interfaz ETD/ETCD

A set of rules applied to the border between data terminal equipment (DTE) and data circuit terminating equipment (DCE) of data communication networks.

Note — The term will normally be used in the context of user services provided through a data communication network. Depending on the nature of the user services it may comprise functions of one or more layers.

1.29 echoplex mode

F: mode échoplex

S: modo ecoplex

A mode of operation whereby characters transmitted by a DTE are automatically returned to that DTE from some specified network node.

1.30 editing

F: édition

S: edición

A function provided by a PAD, which allows the start-stop mode DTE user to edit characters sent to the PAD before action by the PAD and/or onward transmission.

1.31 flow control

F: contrôle de flux

S: control de flujo

In data communication, control of the data transfer rate.

1.32 flow control parameter selection/negotiation and indication for virtual call service

F: sélection, négociation et indication des paramètres de contrôle de flux pour service de communication virtuelle

S: elección, negociación e indicación de parámetros de control flujo para el servicio de ilamada virtual

A user facility for the virtual call service which provides for the packet mode DTE in classes of service 8-11 to select and negotiate the packet and window size and the significance of the *receive packet sequence number* [P(R)] and permits the DCE to indicate the appropriate value of each parameter at the end of the call establishment phase.

1.33 inactive character

F: caractère inactif

S: carácter inactivo

A character that is sent in the data transfer phase as a filler which does not represent information.

1.34 interface

F: interface

S: interfaz

A shared boundary between two functional units, defined by functional characteristics, common physical interconnection characteristics, signal characteristics, and other characteristics, as appropriate.

Note — The concept involves the specification of the connection of two devices having different functions.

1.35 international user class of service

F: catégorie d'usagers du service international

S: clase de servicio de usuario internacional

A category of public data transmission service in a certain network in which the data signalling rate, control signalling rates and other parameters are specified with reference to the services, the interfaces and the terminal operating mode.

1.36 intermediate equipment

F: équipement intermédiaire

S: equipo intermedio

Auxiliary equipment that may be inserted between the data terminal equipment (DTE) and the signal conversion equipment to perform certain additional functions before modulation or after demodulation.

1.37 leased circuit data transmission service

F: service de location de circuits pour transmission de données

S: servicio de transmisión de datos por circuitos arrendados

A service whereby a circuit (or circuits) of the public network is (are) made available to a user or group of users for his (or their) exclusive use.

Note — Where only two data circuit terminating equipments are involved, it is known as a point-to-point facility and where more than two are involved, it is known as a multipoint facility.

1.38 logical channel

F: voie logique

S: canal lógico

In packet mode operation, a means of two-way simultaneous transmission across a *data link*, comprising associated send and receive channels.

Note 1 — A number of logical channels may be derived from a *data link* by packet interleaving.

Note 2 — Several logical channels may exist on the same *data link.*

1.39 multiplex interface

F: interface multiplex

S: interfaz múltiplex

A DTE/DCE interface which conveys the bitstream of a number of subscriber channels by means of time division multiplexing.

1.40 multiplex link

F: liaison multiplex

S: enlace multiplexado

A means of enabling a DTE to have several access channels to the data network over a single circuit.

Note — Three likely methods have been identified:
    a) packet interleaving,
    b) byte interleaving,
    c) bit interleaving.

1.41 modulation rate

F: rapidité de modulation

S: velocidad de modulación

The reciprocal of the measure of the shortest nominal time interval between successive significant instants of the modulated signal.

Note — If this measure is expressed in seconds, this rate is given in bauds.

1.42 network failure

F: défaillance du réseau

S: fallo de red; avería en la red

A circumstance occurring in a network which prevents a service from being offered because the network is not functioning correctly.

1.43 network transfer delay

F: temps de propagation sur le réseau

S: tiempo de transferencia de la red

The time which is required by the network to transfer an entity, offered at the originating DTE/DCE interface, to the destination DTE/DCE interface. Depending on the mode of operation the entity may be a bit, a packet or a message.

1.44 network utility

F: service inter-réseaux

S: servicio interredes

An inter-network administrative signalling mechanism in the call control procedure between switched public data networks.

1.45 network utility field

F: champ des services inter-réseaux

S: campo de servicios interredes

A field to transmit the service information for the network utility. The network utility field complements the user facility field and serves to distinguish user service signalling from network administrative signalling.

1.46 optional user facility

F: service complémentaire facultatif offert aux usagers

S: facilidad facultativa de usuario

A service element not belonging to the set of elements forming a basic user service but enhancing it.

Note 1 — Provision of optional user facilities by Administrations may be considered as essential (E) or additional (A). E-facilities shall be made available by Administrations for international service. A-facilities may be made available by Administrations for national service and can be made available internationally on the basis of bilateral agreement.

Note 2 — Offered optional user facilities may be used by subscribers/users at their discretion. In switched services they can be provided for a certain agreed period of time, or on a per call basis (fixed or negotiated).

Note 3 — In the context of interfaces and signalling or other areas, the term "facility" is being used. Those facilities are not necessarily optional user facilities. It also may be noted that the term "facility" is very often used in the meaning of common language use.

1.47 packet assembly/disassembly (PAD)

F: assemblage-désassemblage de paquets (ADP)

S: empaquetado/desempaquetado de datos (EDD) ensamblado/desensamblado de paquetes

A function which permits nonpacket mode terminals to exchange data in the packet mode.

1.48 packet switched data transmission service

F: service de transmission de données à commutation par paquets

S: servicio de transmisión de datos con conmutación de paquetes

A service involving the transmission and, if necessary, the assembly and disassembly of data in the form of packets.

1.49 page wait

F: page en attente

S: espera de página

A function provided by the PAD which allows for the suspension of transmission of additional characters to the start/stop mode DTE, after a specified number of linefeed (LF) characters (determined by a PAD parameter) have been transmitted by the PAD.

1.50 parity function

F: fonction de parité

S: función de paridad

A function provided by a PAD which allows the start-stop mode DTE and the packet mode DTE to select which of a range (as yet undefined) of operations should be undertaken by the PAD in relation to the parity bit of characters transmitted by the PAD and received by the PAD.

1.51 permanent virtual circuit

F: circuit virtuel permanent

S: circuito virtual permanente

One service of the packet switched data transmission services in which a permanent association exists between two DTEs which is identical to the data transfer phase of a virtual call. No call set-up or clearing procedure is possible or necessary.

1.52 private data network

F: réseau privé pour données

S: red de datos privada

A network established and operated by a private organization for the purpose of data communication applications.

Note — A private network may be connected to one or more public data networks, depending on national regulations.

1.53 public data transmission service

F: service public de transmission de données

S: servicio público de transmisión de datos

A data transmission service established and operated by an Administration and provided by means of a public network. Circuit switched, packet switched and leased circuit data transmission services are specified.

Note 1 — A public data transmission service may be subdivided into derived services.

Note 2 — A public data transmission service or a derived service consists of service elements forming a basic service and of other service elements which are called optional user facilities.

1.54 public data network

F: réseau public pour données

S: red pública de datos

A network established and operated by an Administration for the specific purpose of providing data transmission services to the public. Circuit switched, packet switched and leased circuit data transmission services are feasible, depending on national regulations. The public data network may carry traffic of other services.

1.55 reselection

F: resélection

S: reselección

Process by which a DTE, referred here to as DTE A, can request the PAD to clear the current virtual call established between DTE A and a start-stop mode DTE and then to establish a new virtual call between the start-stop mode DTE and another DTE, DTE B, selected and indicated to the PAD by DTE A.

1.56 subscriber channel in a multiplexed DTE/DCE interface

F: voie d'abonné à une interface multiplex ETTD/ETCD

S: canal de abonado en un interfaz ETD/ETCD múltiplex

A two-way path in a time division multiplexed link exclusively assigned in a multiplex DTE/DCE interface to carry call control information to the network and data between two subscribers.

1.57 switched virtual connection

F: communication virtuelle commutée

S: conexión virtual conmutada

See *virtual call.*

1.58 terminal operating mode

F: mode de fonctionnement du terminal

S: modo de funcionamiento del terminal

In the context of the public data transmission service, the way a data terminal equipment is designed to meet the parameters of an international user class of service.

1.59 time-out

F: temporisation

S: temporización

A parameter related to an enforced event designed to occur at the conclusion of a predetermined elapsed time.

Note — A time-out condition can be cancelled by the receipt of an appropriate time-out cancellation signal.

1.60 transit network identification

F: identification du réseau de transit

S: identificación de la red de tránsito

A network utility that names each transit network controlling a portion of the established or partially established virtual circuit.

1.61   transparent data transfer phase

> *F: phase de transfert transparent de données*

> *S: fase de transferencia transparente de datos*

The phase of a call during which any bit sequence can be transmitted between DTEs.

1.62   user class of service (see also international user class of service)

> *F: catégorie d'usagers du service*

> *S: clase de servicio de usuario*

A category of data transmission provided in a network in which the *data signalling, address selection* and *call progress* signals signalling rates and the terminal operating mode are standardized.

1.63   user service

> *F: service complémentaire offert aux usagers*

> *S: servicio de usuario*

A service available on demand to a user and provided as part of a public data network transmission service.

1.64   virtual call (switched virtual connection)

> *F: communication virtuelle*

> *S: llamada virtual; conexión virtual conmutada*

One service of the packet switched data transmission services in which a call set-up procedure and a call clearing procedure will determine a period of communication between two DTEs in which users' data will be transferred in the network in the packet mode of operation. All the users' data are delivered from the network in the same order in which they are received by the network.

2   List of terms

The following is a list of terms used in the Series X Recommendations, identifying in which Recommendation they are *contained* and in which recommendation they are *explicitly* and/or *implicitly defined.*

It should be noted that the list of definitions and references is not complete. Due to time and manpower limitations, only definitions in the following Recommendations have been included: X.1, X.2, X.3, X.10, X.15, X.20, X.21, X.96, X.121, X.400, X.401, X.408, X.409, X.410, X.411, X.420 and X.430. It is intended to improve this section in the next Study Period by including the terms of the remaining Series X Recommendations.

Implicit definitions should be considered mainly in the context of the cited Recommendation without any prejudice for broader meaning or meaning in another context.

A

Abbreviated address calling
cont. in X.2, X.20, X.21; impl. def. in X.20, X.21

Access barred
cont. in X.15, X.96; impl. def. in X.15, X.96

Access management
cont. in X.400; impl. def. in X.400

Access termination service
cont. in X.411; impl. def. in X.411

Action element
cont. in X.430; impl. def. in X.430

Action element identifier
cont. in X.430; impl. def. in X.430

Actions
cont. in X.430; impl. def. in X.430

Activity discard
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Activity end
cont. in X.410; impl. def. in X.410

Activity interrupt
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Activity management
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Activity resume
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Activity start
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Additional optional user facility
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Additional session reference No.
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Address
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Address block
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Administration management domain
cont. in X.400, X.411; impl. def. in X.400

Alternate recipient allowed
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Alternate recipient allowed
cont. in X.400, X.401, X.411, X.420, X.430; impl. def. in X.400, X.411, X.430

Alternate recipient assignment
cont. in X.400, X.401, X.411, X.420; impl. def. in X.400

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Authorizing users indication
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Auto forwarded indication
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Auto receipt notification
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B

Base attribute set
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Basic functions
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Basic interpersonal messaging service
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Basic service
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Basic service element
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Basic teletex service
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BCC (Blind courtesy copy)
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Bilateral closed user group selection
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Bilateral closed user group with outgoing access
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Bit string
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Body part encryption indication
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Calling line identification
cont. in X.2, X.20, X.21, X.300; impl. def. in X.20, X.21, X.300

Calling SSAP address
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Closed user group outgoing access indication
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Converted information type
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