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PUBLIC DATA NETWORKS

TRANSMISSION, SIGNALLING AND SWITCHING

**INTERWORKING OF INTEREXCHANGE
SIGNALLING SYSTEMS FOR CIRCUIT
SWITCHED DATA SERVICES**

ITU-T Recommendation X.80

(Extract from the *Blue Book*)

NOTES

- 1 ITU-T Recommendation X.80 was published in Fascicle VIII.3 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).
- 2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation X.80

INTERWORKING OF INTEREXCHANGE SIGNALLING SYSTEMS FOR CIRCUIT SWITCHED DATA SERVICES

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

The CCITT,

considering

- (a) that Recommendations X.60 and X.71 define two different signalling systems which are intended for use on international circuits between synchronous data networks;
- (b) that Recommendation X.70 defines a signalling system which is intended for use on international circuits between anisochronous data networks;
- (c) that Administrations and RPOAs have expressed interest in implementing Recommendations X.60, X.70 or X.71 as national signalling systems between national data switching exchanges;
- (d) that Recommendations X.60, X.70 and X.71 have been defined to include the necessary signals to allow interworking between any combination of these signalling systems;
- (e) that there is a need to define the specific interworking requirements between these signalling systems;

unanimously declares

that interworking between any combination of signalling systems conforming to Recommendations X.60, X.70 and X.71 should be as defined in this Recommendation.

1 General

1.1 Principles

This Recommendation provides a set of interworking specifications for CCITT circuit-switched data signalling systems. Interworking is defined as the controlled transfer of signalling information across an interface between different signalling systems where the significance of the transferred information is identical, or where significance is translated in a defined manner, and includes the performance of the appropriate interworking procedures in association with the transfer. These interworking procedures will be performed by an interworking function at a boundary between the two interworking signalling systems.

Interworking commences at call set-up when a link is established between two circuits using different signalling systems and continues throughout the call until release of the connection occurs. Interworking ceases with the release of the connection, whether the release is initiated by the reception of a clear condition from either of the signalling systems involved or by the interworking function itself in response to some abnormal condition.

1.2 Presentation

The specifications are basically represented by flow charts consistent with the CCITT Specifications and Descriptions Language (SDL), described in Recommendations Z.101 to Z.103; and are used to describe the logical requirements of the interworking function. In addition, two tables are included to show the signalling sequences required for a typical interworking situation. Narrative description has been reduced to a minimum.

SDL provides a method of presentation which is both comprehensive and independent of implementation, ensuring that all interworking conditions can be covered in a systematic manner. The logic of each signalling system is covered in the relevant signalling Recommendations X.60, X.70 or X.71.

2 Interworking procedures between Recommendations X.60 and X.71

The present § 2 details the specific requirements for interworking between an X.60 and an X.71 signalling system.

Table 1/X.80 illustrates the relationship between the signals on the X.60 side of the interworking function and the corresponding signals on the X.71 side. It illustrates the simple case of a basic call which originates in an "X.60 network" and terminates in an "X.71 network", and which does not invoke any additional facilities, and it assumes that the call is successful. The call clear-down is initiated by the customer in the X.60 network.

There are, however, several combinations of facilities which could be required on a particular call which complicate the interworking procedures, in particular the instant of connect through. In Table 1/X.80 the reception of the *Call Connected (CC)* signal from the Recommendation X.71 signalling system defines the conclusion of the call set-up sequence at the interworking point and hence the instant of connect through. If the call involves additional facilities the reception of the *Transit Through Connect (TTC)* signal from the Recommendation X.71 signalling system initiates the additional protocols necessary to setting up the call successfully. Table 2/X.80 illustrates an example involving these additional protocols for a call requiring both calling and called line identities and including a positive call progress indication.

Appendix I to this Recommendation illustrates further examples of interworking situations which can occur for the X.60 to X.71 case. The appendix illustrates examples of interworking situations where two "X.71 networks" transit an "X.60 network" or two "X.60 networks" transit an "X.71 network".

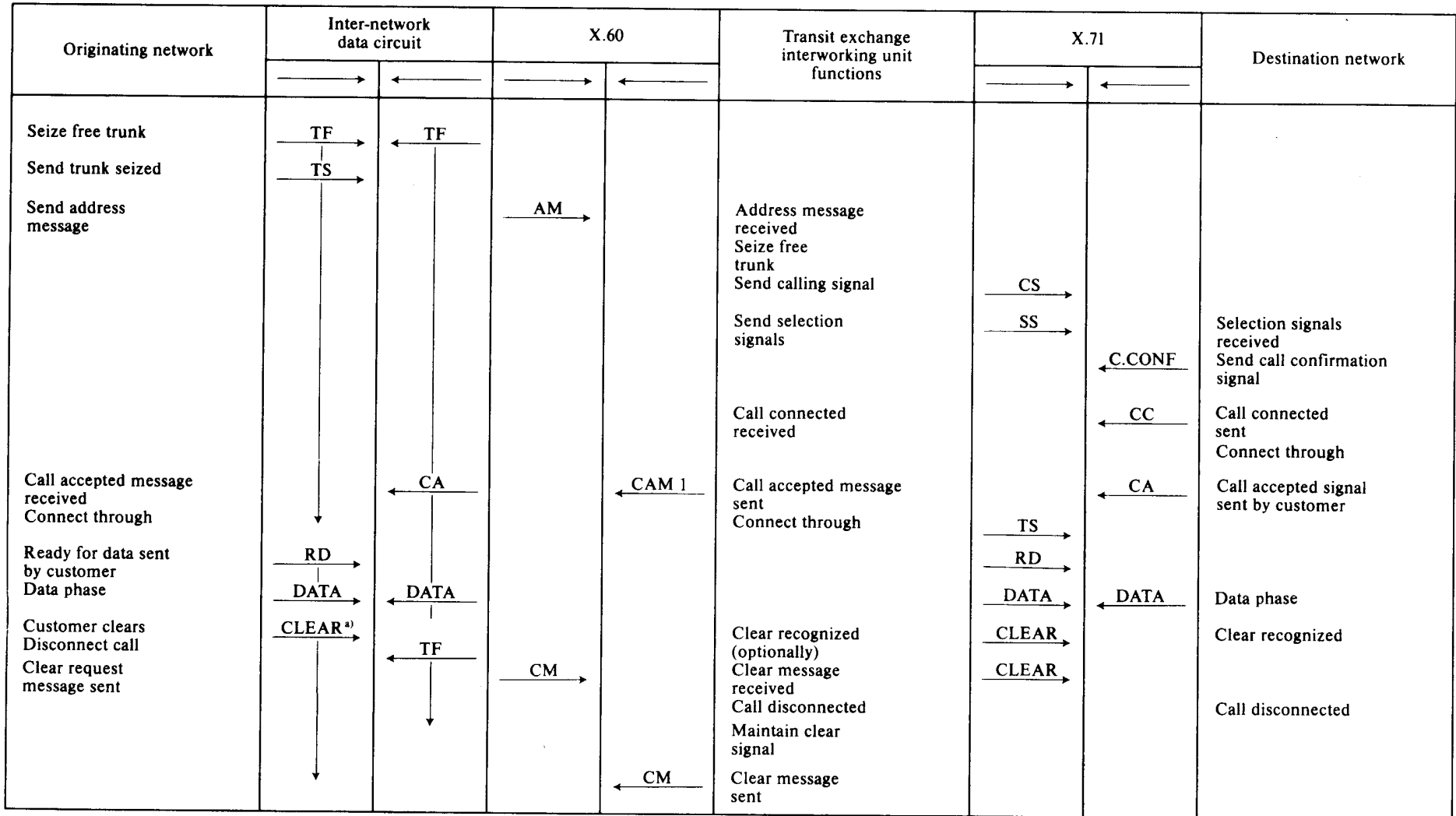
2.1 *Interworking from Recommendation X.60 to X.71*

Figure 1/X.80 shows the transit exchange interworking functions required to enable an X.60 to X.71 call to be connected.

In response to the selection information sent to the X.71 network, one of two signals may be received: *CC* or *TTC* as described above.

TABLE 1/X.80

X.60 to X.71 interworking situation—simple case, customer in X.60 network initiates clear



X.60 signals + messages

- TF Trunk free
- TS Trunk seized
- AM Address message
- CAM 1 Call accepted (CC) message
- CM Clear message

X.71 signals

- CS Calling signal
- SS Selection signals
- C.CONF Call confirmation
- CC Call connected
- CLEAR

Customer signals

- RD Ready for data
- CA Call accepted
- DATA
- Clear request

^{a)} Customer clear signal same as trunk free.

TABLE 2/X.80
X.60 to X.71 interworking situation – complex case, call set-up only, no internetwork data circuits shown for X.60 network

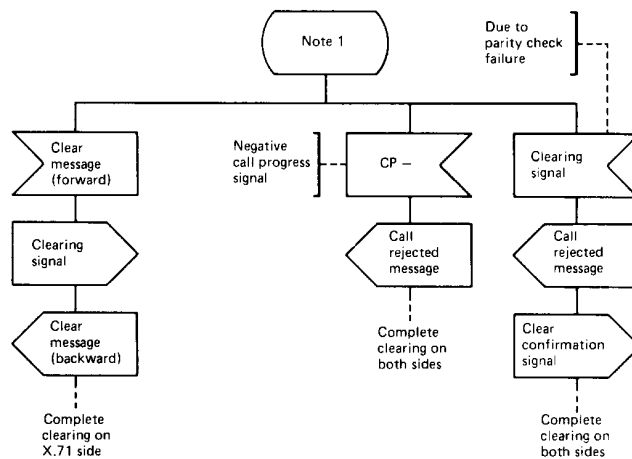
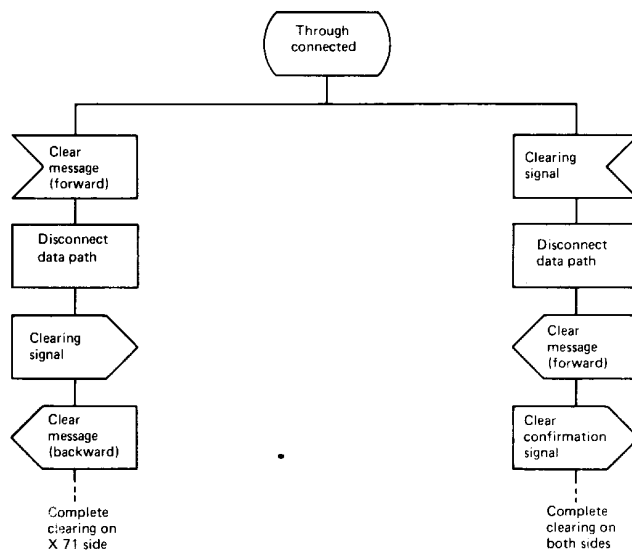
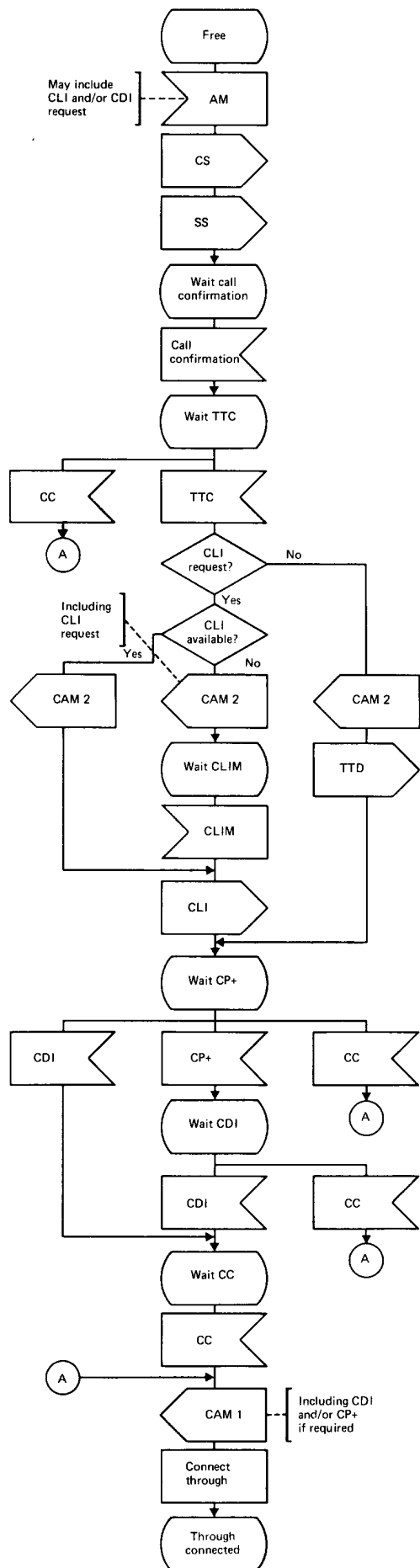
Originating network	X.60		Transit exchange interworking unit functions	X.71		Destination network
	→	←		→	←	
Seize free trunk Send trunk seized Send address message (includes a request for called line identity)	→ AM (CDIR)		Address message received Seize free trunk Send calling signal	→ CS		
			Send selection signals (including request for called line identity) TTC signal received	→ SS	← C.CONF ← TTC	Selection signals received Call confirmation signal sent Transit through-connect (including request for calling line identity)
Call accepted message (TTC) received Calling line identity message sent	→ CLIM	← CAM 2	Call accepted message (TTC) sent (including request for calling line identity) Calling line identity message received Calling line identity sent	→ CLI		Calling line identity received Called line identity sent
			Called line identity, call progress and call connected signals received		← CDI/CP+ ← CC	Call progress signal sent Call connected signal sent
Call accepted message received		← CAM 1	Call accepted message sent including called line identity and call progress signal			
Connect through			Connect through			Connect through

X.60 messages

AM Address message
CAM 2 Call accepted (TTC)
CAM 1 Call accepted (CC)
CLIM Calling line identity

X.71 signals

CS Calling signal
SS Selection
C.CONF Call confirmation
CC Call connected
TTC Transit through-connected
CLI Calling line identification
CDI Called line identification
CP+ Positive call progress



CCITT - 80760

Note 1 - Any state among: Wait call confirmation, Wait TTC, Wait CLIM, Wait CP+, Wait CDI, Wait CC.

Note 2 - Clear messages contain the appropriate signal (see Recommendation X.61).

- AM Address message
- CAM 1 Call accepted message, containing call accepted signal
- CAM 2 Call accepted message, containing TTC signal
- CLIM Calling line identity message
- CS Calling signal
- SS Selection signals; can include request for CDI
- CC Call connected signal
- TTC Transit through-connect; can include request for CLI
- CLI Calling line identity
- CDI Called line identity
- CP+ Positive call progress signal

FIGURE 1/X.80

Transit exchange functions for interworking from X.60 network to X.71 network

The consequent *Call Accepted Message(s)* (CAM) which are transmitted on the X.60 side of the interworking unit function can contain:

- a) The *call accepted* signal when a *CC* signal was received on the X.71 side. Note that this type of CAM (designated CAM 1) can also contain the *called line identity* and/or a *positive call progress* signal for calls which have initiated the additional protocols and are now ready to connect through. [See c) below.]
- b) The *transit through connect* signal when a *TTC* signal was received on the X.71 side. The *TTC* signal may or may not *request the calling line identity*. The consequent *call accepted* message (designated CAM 2) can therefore contain:
 - i) a request for the *calling line identity* if it was requested and it is not available;
 - ii) no request if the calling line identity is already available as part of the *originating address* message;
 - iii) no request if the *calling line identity* was not requested.

In i) a *calling line identity* message is received from the X.60 side in response to the CAM 2. Then the *calling line identity* can be transmitted on the X.71 side.

In ii) the *calling line identity* can be transmitted on the X.71 side.

In iii) a Transit centres Through-Connected (TTD) signal is transmitted on the X.71 side.
- c) A *positive call progress* signal and/or the *called line identity* when they were received on the X.71 side preceding the *call connected (CC)* signal. This information can be included in the CAM 1 sent on the X.60 side to complete the through-connection.

2.2 Interworking from Recommendation X.71 to X.60

Figure 2/X.80 shows the transit exchange interworking functions required to enable an X.71 to X.60 call to be connected.

The signals that can be transmitted on the X.71 side of the interworking unit function in response to a CAM 1 or CAM 2 message are as follows:

- a) The *call connected (CC)* signal either directly or after the transmission of *called* and/or *calling line identification* and/or a *positive call progress* signal.
- b) If the CAM 1 or CAM 2 contains a *request for calling line identity*, a *TTC* signal is transmitted with a request for *calling line identification* on the X.71 side. In response, the *calling line identity* is received from the X.71 side and a *calling line identity message* transmitted on the X.60 side.

Note - If the *calling line identity* is sent as a result of a CAM 2 request, a subsequent CAM 1, which may contain the *called line identity*, must be sent on the X.60 side in order to complete the call set-up.
- c) Where *calling line identity* is not required by a CAM 2, a *TTC* signal is sent on the X.71 side. A *TTD* signal will be received in response and this may be received before or after a CAM 1, which may contain the *called line identity*, has been received from the X.60 side in order to complete the call.
- d) In b) and c) a *positive call progress* signal and/or the *called line identity* can be sent on the X.71 side before the *CC* signal.
- e) Where a CAM 1 is received without a *request for calling line identity* but including the *called line identity* or a *positive call progress* signal, a *TTC* signal is sent on the X.71 side. When a *TTD* signal has been received in response, the *called line identity* and/or the *positive call progress* signal may be sent before the *CC* signal.

2.3 Call clear-down

A *call clear-down* signal can originate in either the X.60 or X.71 network. The interworking function must therefore be capable of detecting *clear* signals and messages, which can occur at any time during the call set-up or data phase of a call, and take the appropriate action as detailed below:

- a) A clear request *signal received from the X.71 network*

This will initiate disconnection of the call at the interworking function, the transmission of a clear confirmation signal to the X.71 network and a clear message to the X.60 network. At this point interworking ceases and each network clears down according to the normal X.60 or X.71 procedures.

b) A clear message *received from the X.60 network*

This will initiate disconnection of the call at the interworking function, the transmission of a clear message to the X.60 network and a clear request signal to the X.71 network. At this point interworking ceases and each network clears down according to the normal X.60 or X.71 procedures.

Note - The interworking function may optionally detect the internetwork data circuit clear request signal initiated by the user in the X.60 network. This will cause the disconnection of the call at the interworking function and initiate the same procedures as described above.

2.4 *Call failure conditions during call set-up*

Supervision of time-outs during call set-up takes place as stated in the signalling Recommendations X.71 and X.60 respectively.

The expiry of such a supervisory-timer will lead to normal clearing as shown in Figures 1/X.80 and 2/X.80.

3 Interworking procedures between Recommendations X.70 and X.71

Since the proposals for Recommendations X.70 and X.71 are closely related, interworking between an X.70 and an X.71 network should be straightforward; however the interworking procedures required are for further study.

4 Interworking procedures between Recommendations X.60 and X.70

The required interworking procedures should be similar to the Recommendation X.60/71 case; however they are for further study.

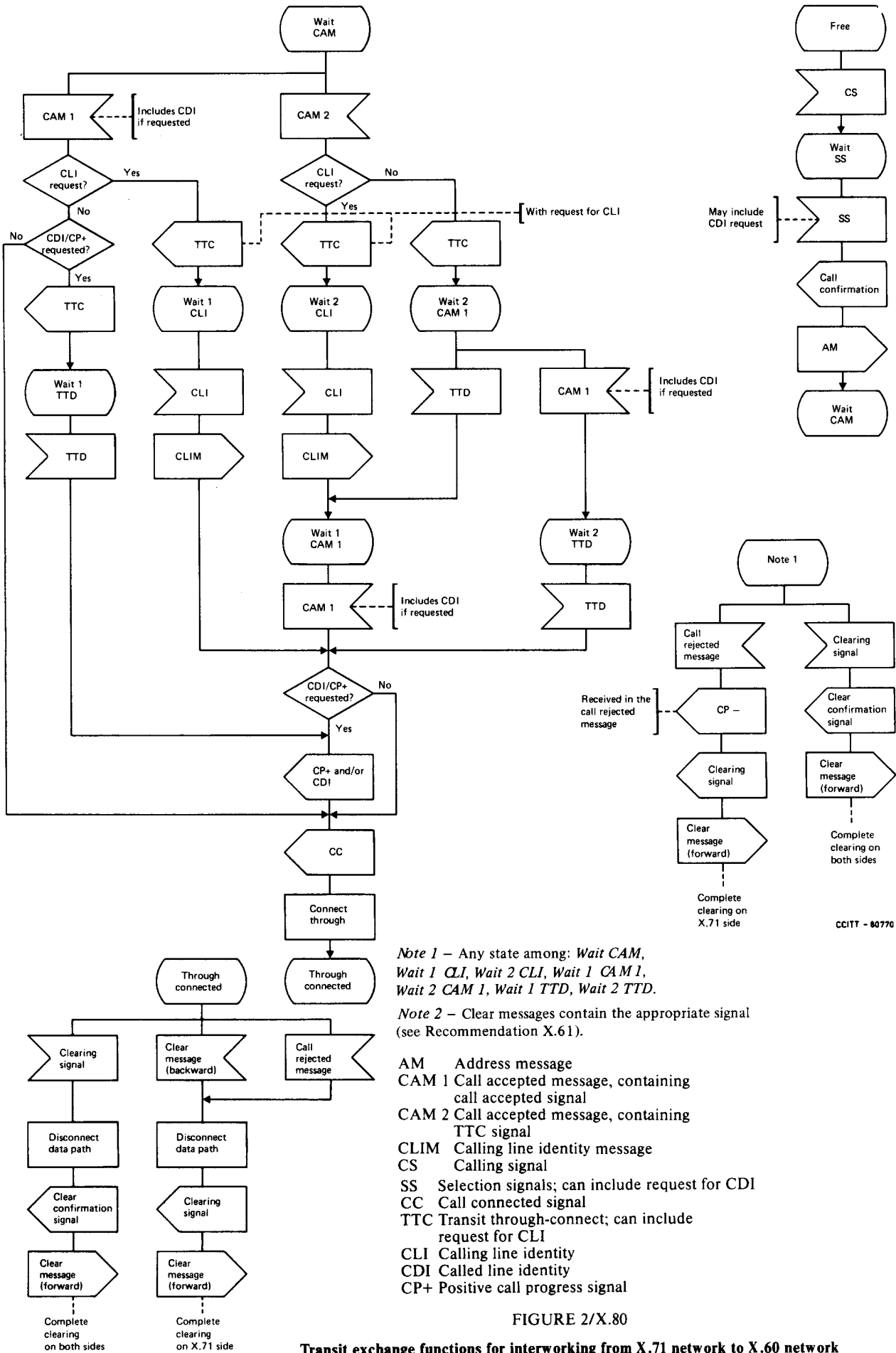


FIGURE 2/X.80

Transit exchange functions for interworking from X.71 network to X.60 network

APPENDIX I

(to Recommendation X.80)

Interworking cases, Recommendations X.60/X.71

The following sequence charts illustrate examples of complex transit interworking situations.

Key to sequence charts

O - Originating network

T - Transit network

D - Destination network

X - Data path through-connect

Recommendation X.60

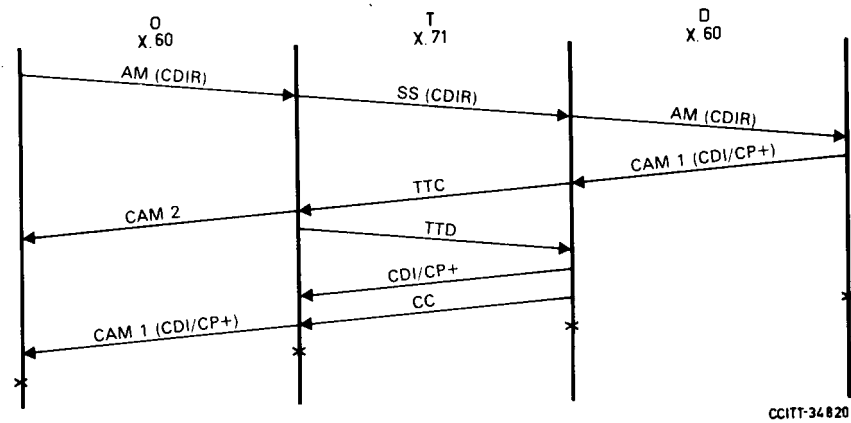
AM	-	Address message
AM (CLI)	-	Address message with calling line identity (CLI)
AM (CDIR)	-	Address message with request for called line identity (CDI)
AM (CLI + CDIR)	-	Address message with CLI and request for CDI
CAM 1	-	Call accepted message contains call accepted signal; can contain CDI, CLI request and/or positive call progress signal
CAM 2	-	Call accepted message; TTC signal can contain CLI request
CLIM	-	Calling line identity message

Recommendation X.71

CS	-	Calling signal
SS	-	Selection signals; can include request for called line identity
C.CONF	-	Call confirmation signal
CC	-	Call connected signal
TTC	-	Transit through-connect signal can include request for Calling Line Identity
TTD	-	Transit centres through-connected signal
CLI	-	Calling line identity
CDI	-	Called line identity
CP+	-	Positive call progress signal

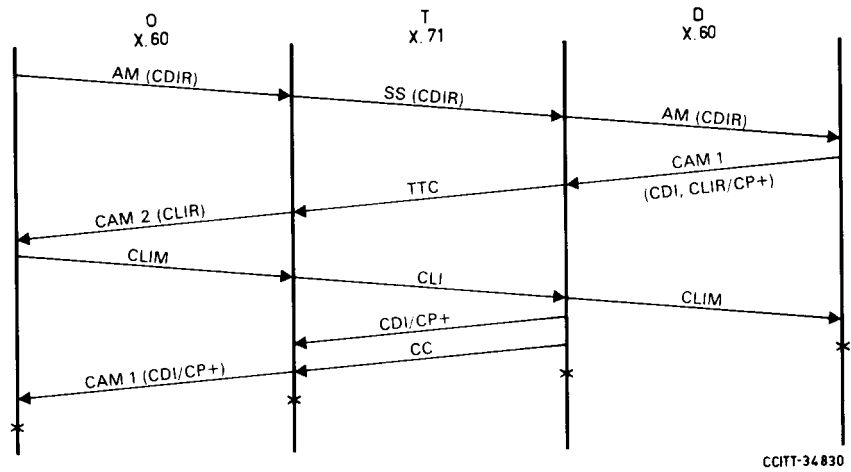
1.1 Interworking, Recommendations X.60/X.71/X.60

a) Called line identity and/or positive call progress signal required, calling line identity not required

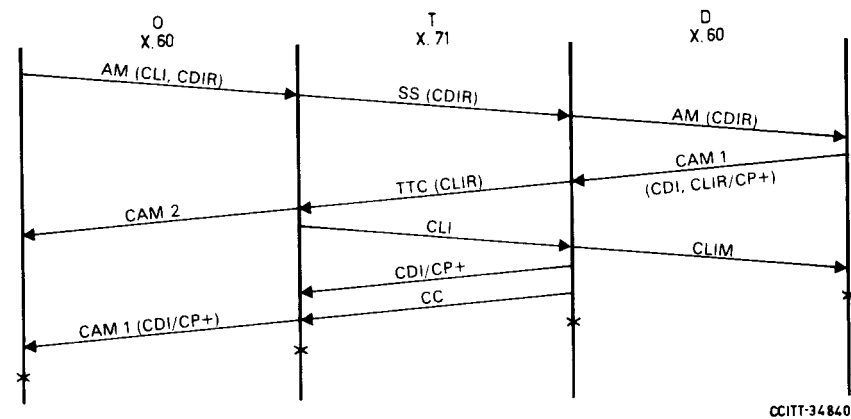


b) Both called and calling line identity required and/or positive call progress signal

First case

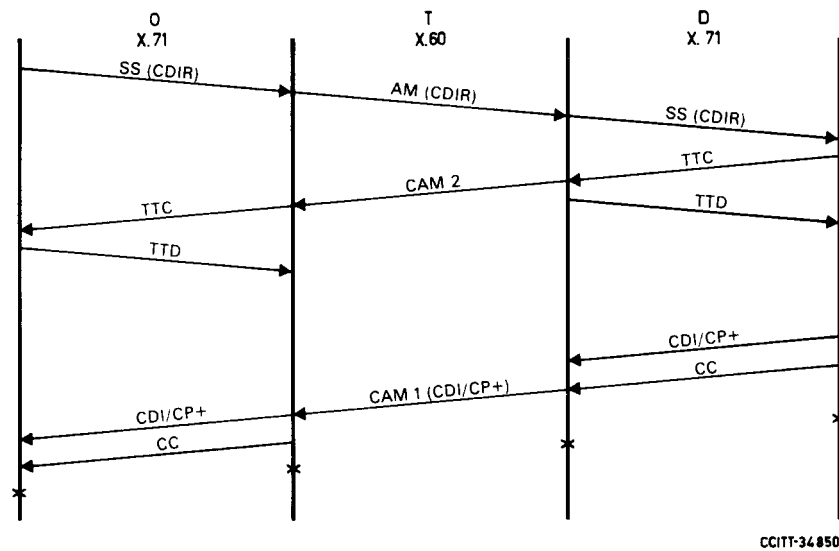


Second case



1.2 Interworking, Recommendations X.71/X.60/X.71

a) Called line identity and/or positive call progress signal, calling identity not required



b) Calling line identity and called line identity and/or positive call progress signal required

