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SERIES I: INTEGRATED SERVICES DIGITAL
NETWORK (ISDN)

Overall network aspects and functions, ISDN user-
network interfaces

**ISDN USER-NETWORK INTERFACES –
REFERENCE CONFIGURATIONS**

Reedition of CCITT Recommendation I.411 published in
the Blue Book, Fascicle III.8 (1988)

NOTES

1 CCITT Recommendation I.411 was published in Fascicle III.8 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.

Recommendation I.411

ISDN USER-NETWORK INTERFACES – REFERENCE CONFIGURATIONS

(Malaga, Torremolinos, 1984)

1 General

1.1 This Recommendation provides the reference configurations for ISDN user-network interfaces.

1.2 From the user's perspective, an ISDN is completely described by the attributes that can be observed at an ISDN user-network interface, including physical, electromagnetic, protocol, service, capability, maintenance, operation and performance characteristics. The key to defining, and even recognizing, an ISDN is the specification of these characteristics.

1.3 An objective of ISDN is that a small set of compatible user-network interfaces can economically support a wide range of user applications, equipment and configurations. The number of different user-network interfaces is minimized to maximize user flexibility through terminal compatibility (from one application to another, one location to another, and one service to another) and to reduce costs through economies in production of equipment and operation of both ISDN and user equipment. However, different interfaces are required for applications with widely different information rates, complexity, or other characteristics, as well as for applications in the evolutionary stages. In this way, simple applications need not to be burdened with the cost of accommodating features employed by complex applications.

1.4 Another objective is to have the same interfaces used even though there are different configurations (e.g. single terminal versus multiple terminal connections, connections to a PABX versus direct connections into the network, etc.) or different national regulations.

2 Definitions

2.1 **Reference configurations** are conceptual configurations useful in identifying various possible physical user access arrangements to an ISDN. Two concepts are used in defining reference configurations: reference points and functional groupings. Layout and application examples of reference configurations are given in § 3.

2.2 **Functional groups** are sets of functions which may be needed in ISDN user access arrangements. In a particular access arrangement, specific functions in a functional group may or may not be present. Note that specific functions in a functional group may be performed in one or more pieces of equipment.

2.3 **Reference points** are the conceptual points dividing functional groups. In a specific access arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there may not be any physical interface corresponding to the reference point. Physical interfaces that do not correspond to a reference point (e.g. transmission line interfaces) will not be the subject of ISDN user-network interface Recommendations.

3 Reference configuration

3.1 The reference configurations for ISDN user-network interfaces define reference points and types of functions that can be provided between reference points. Figure 1/I.411 shows the reference configurations, while Figures 2/I.411, 3/I.411 and 4/I.411 show examples of applications of such configurations.

3.2 The ISDN user-network interface Recommendations in the I-Series apply to physical interfaces at reference points S and T, using the recommended interface structures according to Recommendation I.412. At reference point R, physical interfaces in accordance with other Recommendations (e.g. the X-Series interface Recommendations) may be used.

Note 1 – Physical interfaces not included in CCITT Recommendations may appear at reference point R.

Note 2 – There is no reference point assigned to the transmission line, since an ISDN user-network interface is not envisaged at this location.

3.3 Figure 1a/I.411 defines the reference configuration with the functional groups NT1, NT2 and TE1. Figure 1b/I.411 illustrates that TE1 may be replaced by the combination of TE2 and TA.

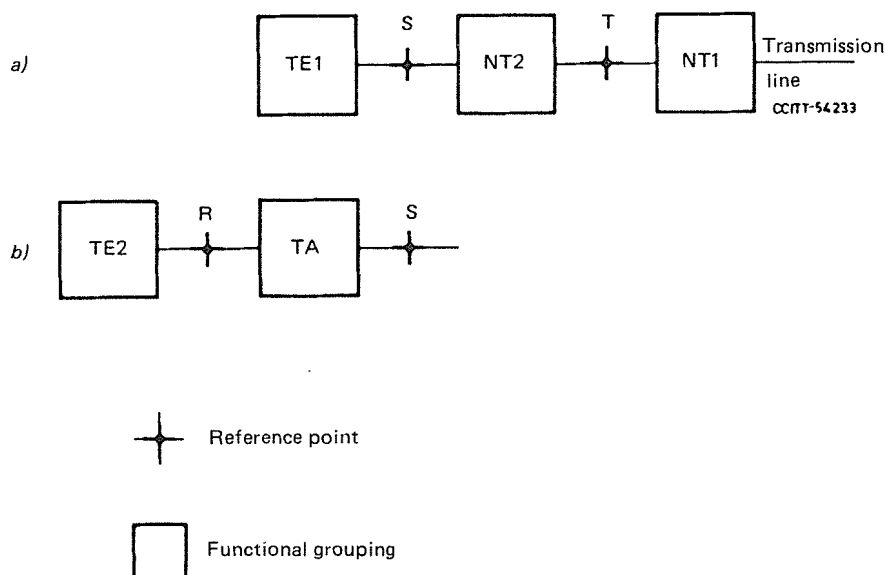


FIGURE 1/I.411
Reference configurations for the ISDN user-network interfaces

3.4 Lists of functions for each functional group are given below. Each particular function is not necessarily restricted to a single functional group. For example, “interface termination” functions are included in the function lists of NT1, NT2 and TE. The function lists for NT2, TE and TA are not exhaustive. For a particular access arrangement, specific functions in a functional group are either present or absent.

The functional groups are described in relation to the ISDN protocol reference model in Recommendation I.320.

3.4.1 Network termination 1 (NT1)

This functional group includes functions broadly equivalent to layer 1 (physical) of the OSI reference model. These functions are associated with the proper physical and electromagnetic termination of the network. NT1 functions are:

- line transmission termination;
- layer 1 line maintenance functions and performance monitoring;
- timing;
- power transfer;
- layer 1 multiplexing;
- interface termination, including multidrop termination employing layer 1 contention resolution.

3.4.2 Network termination 2 (NT2)

This functional group includes functions broadly equivalent to layer 1 and higher layers of the Recommendation X.200 reference model. PABXs, local area networks, and terminal controllers are examples of equipment or combinations of equipment that provide NT2 functions. NT2 functions include:

- layers 2 and 3 protocol handling;
- layers 2 and 3 multiplexing;
- switching;

- concentration;
- maintenance functions; and
- interface termination and other layer 1 functions.

For example, a simple PABX can provide NT2 functions at layers 1, 2 and 3. A simple terminal controller can provide NT2 functions at only layers 1 and 2. A simple time division multiplexer can provide NT2 functions at only layer 1. In a specific access arrangement, the NT2 functional group may consist of only physical connections.

3.4.3 Terminal equipment (TE)

This functional group includes functions broadly belonging to layer 1 and higher layers of the Recommendation X.200 reference model. Digital telephones, data terminal equipment, and integrated work stations are examples of equipment or combinations of equipment that provide the functions. The TE functions are:

- protocol handling;
- maintenance functions;
- interface functions;
- connection functions to other equipments.

3.4.3.1 Terminal equipment type 1 (TE1)

This functional group includes functions belonging to the functional group TE, and with an interface that complies with the ISDN user-network interface Recommendations.

3.4.3.2 Terminal equipment type 2 (TE2)

This functional group includes functions belonging to the functional group TE but with an interface that complies with interface Recommendations other than the ISDN interface Recommendation (e.g. the X-Series interface Recommendations) or interfaces not included in CCITT Recommendations.

3.4.4 Terminal adaptor (TA)

This functional group includes functions broadly belonging to layer 1 and higher layers of the Recommendation X.200 reference model that allow a TE2 terminal to be served by an ISDN user-network interface. Adaptors between physical interfaces at reference points R and S or R and T are examples of equipment or combinations of equipment that provide TA functions.

4 Physical realizations of reference configurations

4.1 Figure 2/I.411 gives examples of configurations illustrating combinations of physical interfaces at reference points R, S and T; Figures 2a/I.411 and 2b/I.411 show separate interfaces at S and T; Figures 2c/I.411 and 2d/I.411 show an interface at S but not T; Figures 2e/I.411 and 2f/I.411 show an interface at T but not S; Figures 2g/I.411 and 2h/I.411 show an interface at S and T where they coincide. Additionally, Figures 2b/I.411, 2d/I.411, 2f/I.411 and 2h/I.411 show an interface at reference point R.

4.2 Figures 3/I.411 and 4/I.411 show examples of physical implementations. The examples given in Figure 3/I.411 show physical realizations of functional groups TE, NT1 and NT2, based on physical interfaces occurring at reference points R, S and T. The examples given in Figure 4/I.411 show applications of the reference configurations to physical configurations when multiple physical interfaces occur at a reference point.

The examples given in Figure 4/I.411 are not intended to be either exhaustive or mandatory. Square blocks in Figures 3/I.411 and 4/I.411 represent equipment implementing functional groupings.

Note – TE1 or TE2 + TA may be used interchangeably in Figure 4/I.411.

4.2.1 Figures 4a/I.411 and 4b/I.411 show applications of the reference configurations in the cases where NT2 functions consist of only physical connections. Figure 4a/I.411 describes the direct physical connection of multiple TEs (TE1s or TE2s + TAs) to NT1 using a multidrop arrangement (i.e. a bus). Figure 4b/I.411 illustrates the separate connection of a number of TEs to NT1.

In these cases, all of the characteristics of the physical interfaces applied at reference points S and T must be identical.

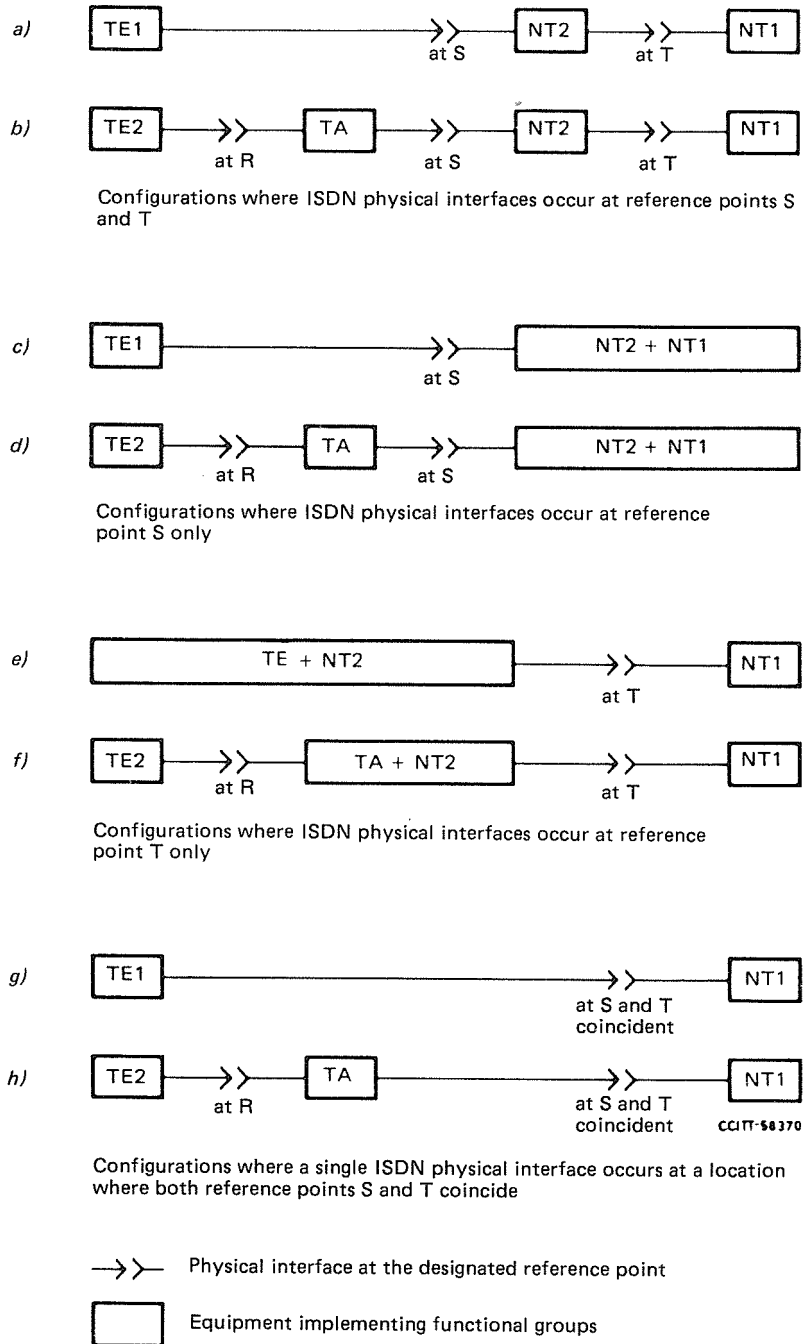
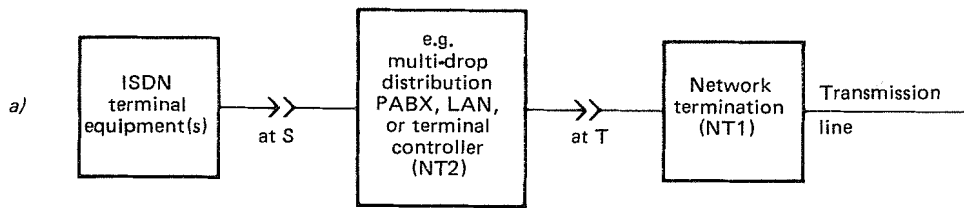


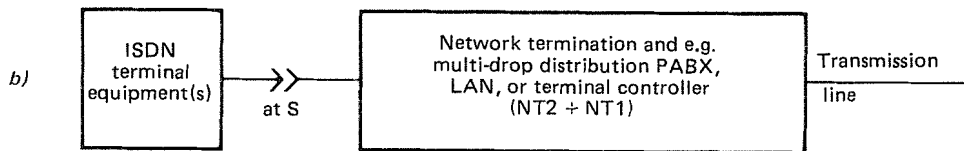
FIGURE 2/I.411
Examples of physical configurations

4.2.2 Figure 4c/I.411 shows the provision of multiple connections between NT2 and TEs. NT2 may include various types of distribution arrangements, such as star, bus or ring configuration included within the equipment. Figure 4d/I.411 shows a case where a bus distribution is used between TEs and the NT2 equipment.

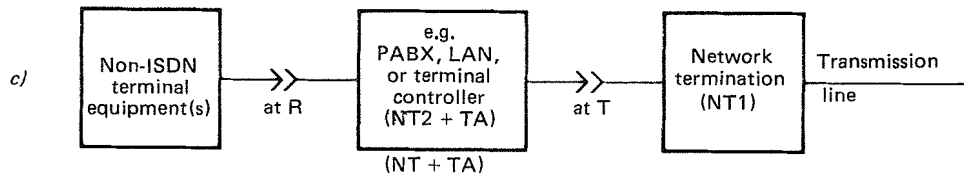
4.2.3 Figures 4e/I.411 and 4f/I.411 show arrangements where multiple connections are used between NT2 and NT1 equipment. In particular, Figure 4e/I.411 illustrates the case of multiple NT1 equipment, while Figure 4f/I.411 refers to the case where NT1 provides layer 1 upward multiplexing of the multiple connections.



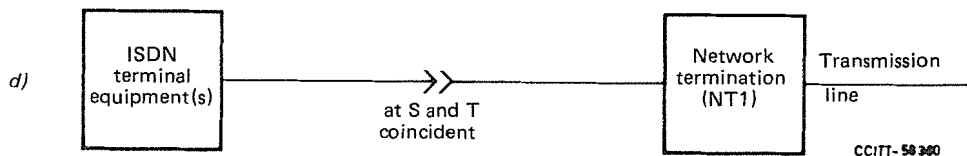
An implementation (see Figure 2a/I.411) where ISDN physical interfaces occur at reference points S and T.



An implementation (see Figure 2c/I.411) where an ISDN physical interface occurs at reference point S but not T.



An implementation (see Figure 2f/I.411) where an ISDN physical interface occurs at reference point T but not S.



An implementation (see Figure 2g/I.411) where a single ISDN physical interface occurs at a location where both reference points S and T coincide.

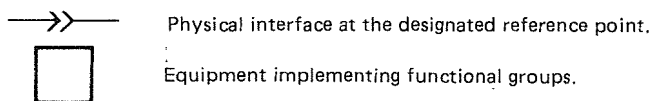


FIGURE 3/I.411

Examples of implementation of NT1 and NT2 functions

4.2.4 Figure 4g/I.411 illustrates the case where NT1 and NT2 functions are merged in the same equipment; the corresponding merging of NT1 and NT2 functions for other configurations in Figure 4/I.411 may also occur.

4.2.5 Figure 4h/I.411 illustrates the case where TA and NT2 functions are merged in the same equipment; the corresponding merging of TA and NT2 functions for other configurations in Figure 4/I.411 may also occur.

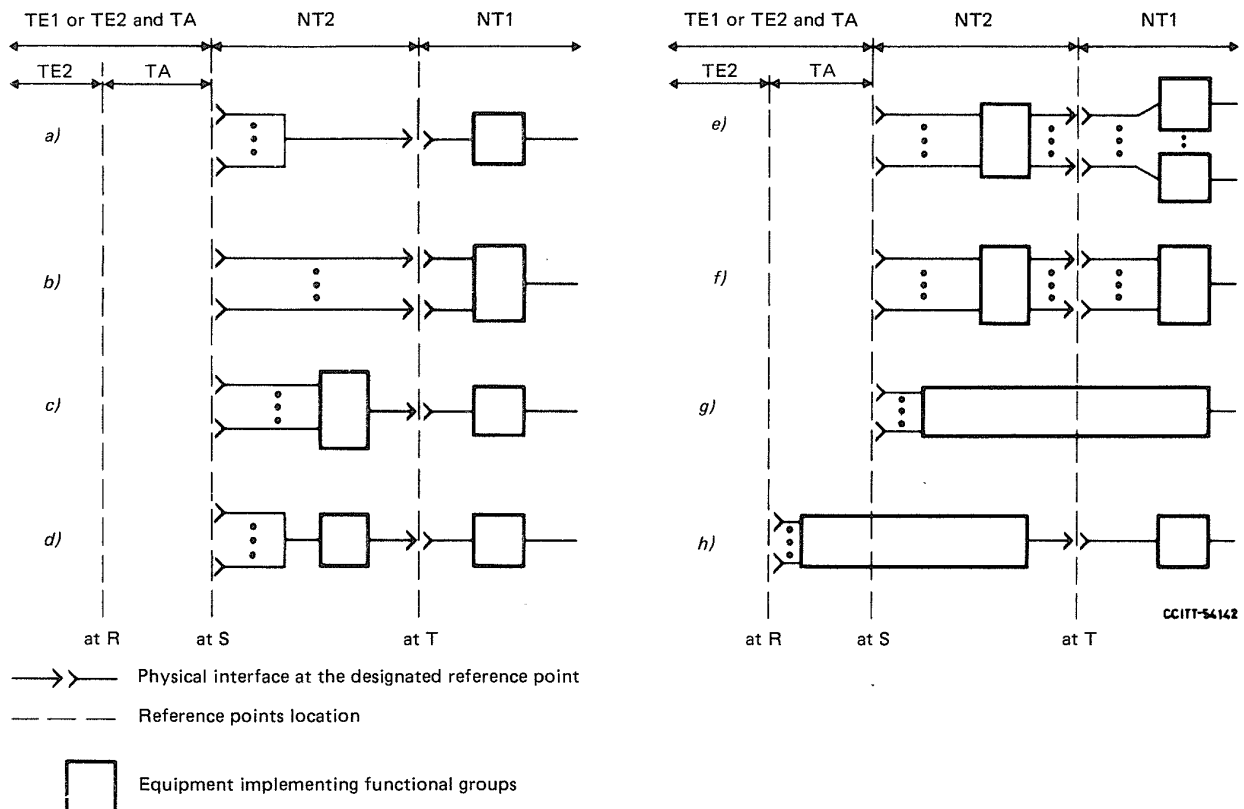


FIGURE 4/I.411

Examples of physical configurations employing multiple connections

4.2.6 In addition to the examples of physical implementation shown in Figures 3/I.411 and 4/I.411, a possible combination of NT1, NT2 and TA into one physical entity could be considered, in which both reference points S and T exist but are not realized as physical interfaces. Such an implementation is to be considered an interim means of providing connection to an ISDN and might be used to complement the recommended means of connecting terminals via physical interfaces at reference points S and T in the early stages of ISDN implementation. This should not be considered as a reference configuration because it poses significant problems in relation to the models of ISDN presently being studied.

4.2.7 These physical implementations are limited in their arrangements and combinations by the electrical and other characteristics of the interface specifications and equipment.

4.3 The reference-configurations given in Figure 1/I.411 apply for the specification of the interface structures and access arrangements given in Recommendation I.412.

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