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OF ITU

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INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

OVERALL NETWORK ASPECTS AND FUNCTIONS

B-ISDN FUNCTIONAL ARCHITECTURE

ITU-T Recommendation I.327

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation I.327 was revised by the ITU-T Study Group XVIII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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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B-ISDN FUNCTIONAL ARCHITECTURE

(Geneva, 1991; revised Helsinki, 1993)

1 Introduction

The general functional architecture model for the ISDN is described in Recommendation I.324. The concepts and associated definitions adopted in Recommendation I.324 also apply to the B-ISDN, i.e. reference configurations, functional group, reference points.

The objective of this Recommendation is to provide a basic functional architecture of the B-ISDN to complement Recommendation I.324. The model is not intended to require or exclude any specific implementation of the B-ISDN but to provide a guide for the specification of B-ISDN capabilities.

Recommendation I.310 describes the functions of an ISDN. These functions are by their nature static (i.e. time-independent). The relative distribution and allocation of these functions is the subject of the architecture of the ISDN and is described in this Recommendation. The dynamic aspects of these functions are modelled in Recommen-dation I.310 as executive processes.

Therefore, the key components in this architecture model are: the functions which are contained in the B-ISDN, where they are located and the relative topology for their distribution in the B-ISDN.

2 General architecture of the B-ISDN

In B-ISDN implementations some of the B-ISDN functions will be implemented within the same network elements, whereas other specific B-ISDN functions will be dedicated to specialized network elements. Various different B-ISDN implementations are likely to be realized depending on national conditions.

A basic component of the B-ISDN is a network for asynchronous transfer mode (ATM) switching of both constant bit rate (CBR) and variable bit rate (VBR) end-to-end connections. These connections will support 64 kbit/s based ISDN services.

3 Architectural aspects of the B-ISDN

The basic architectural model defined in Recommendation I.324 is complemented as shown in Figure 1. This shows the main information transfer and signalling capabilities of the B-ISDN.

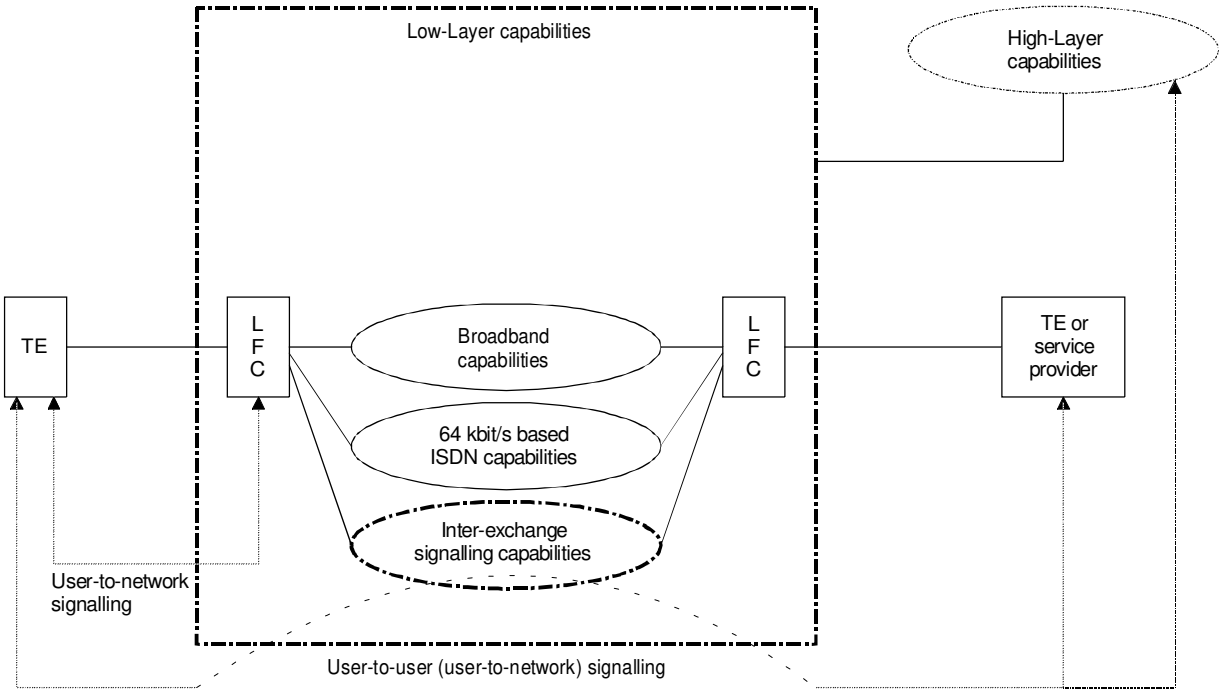
The architecture of the B-ISDN includes low Layer capabilities and high Layer capabilities. These capabilities support services within the B-ISDN and within other networks by means of interworking B-ISDN with those other networks.

3.1 Low Layer capabilities

From the functional capabilities of the B-ISDN, as shown in Figure 1, the information transfer capabilities require further description.

Broadband information transfer is provided by ATM at the B-ISDN user-network interface (UNI) and at switching entities inside the network.

ATM is a specific packet oriented transfer mode using an asynchronous time division multiplexing technique. The multiplexed information flow is organized in fixed size blocks, called cells. A cell consists of an information field and a header: the primary role of the header is to identify cells belonging to the same virtual channel connection. Cells are assigned on demand, depending on the source activity and the available resources. Cell sequence integrity on a virtual channel connection is preserved by the ATM layer.



LFC Local function capabilities
TE Terminal equipment

FIGURE 1/I.327

Basic architecture model of the B-ISDN

ATM is a connection oriented technique. A connection within the ATM layer consists of one or more links, each of which is assigned an identifier. These identifiers remain unchanged for the duration of the connection. It should be noted that signalling information for a given connection is conveyed using a separate identifier.

Although ATM is a connection oriented technique, it does offer a flexible transfer capability common to all services, including connectionless services. Examples of mechanisms supporting connectionless data services are illustrated in Annex A.

The switching and transmission capabilities, as described in Recommendation I.324, are also applicable in B-ISDN. The support of 64 kbit/s based ISDN services by a network based on ATM needs further study.

3.2 High layer capabilities

Normally, the high layer functional capabilities are involved only in the terminal equipment. However, for the support of some services, provision of high layer functions could be made via special nodes in the B-ISDN belonging to the public network or to centres operated by other organizations and accessed via B-ISDN user-network or network-node interfaces (NNIs).

4 Location of functions in the B-ISDN

4.1 Overall

In considering a B-ISDN call (i.e. an instance of a telecommunication service) two major functional areas are involved:

i) the customer equipment (TE and optional customer network),

ii) the public B-ISDN.

In the case where the customer network is a B-ISPBX based network providing the same B-ISDN connection type as the public B-ISDN, then the overall B-ISDN connection ends at the S_B reference point as shown in Figure 2.

NOTES

1 In the case where the customer network is null then the B-ISDN connection type can be considered to end at the coincident S_B, T_B reference point.

2 Other configurations are possible where the call is asymmetrical, or terminates in or involves HLFs.

3 The terms "B-ISPBX/private B-ISDN" and "public B-ISDN" do not presuppose a particular regulatory situation in any country and are used purely for technical reasons.

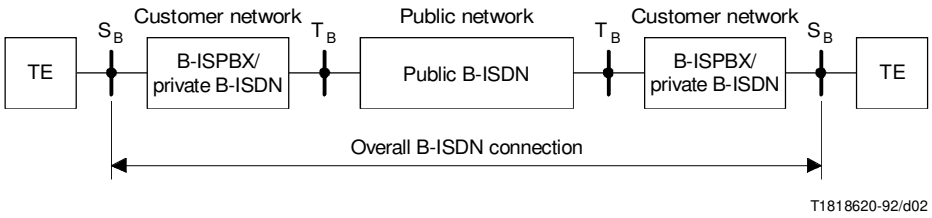


FIGURE 2/I.327

Overall B-ISDN reference configuration for a mixed B-ISPBX/public B-ISDN scenario

4.2 Partitioning of the overall B-ISDN connection

The partitioning of functions within the B-ISDN connection type is done by using connection elements, basic connection components and reference points as defined in Recommendation I.324.

4.2.1 Connection elements

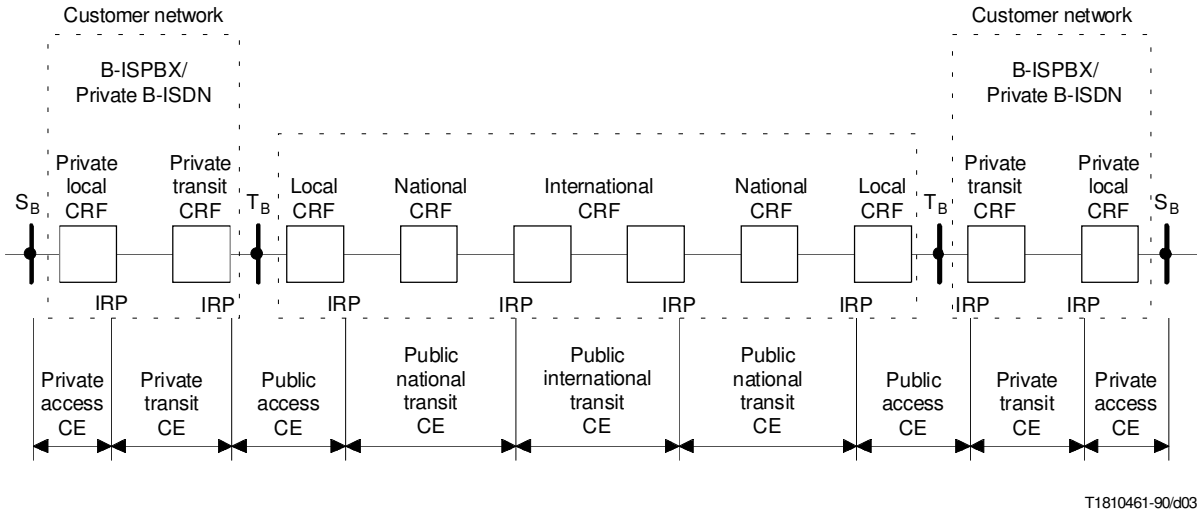
The first level of partitioning of the overall B-ISDN connection type is the connection element (CE). The partitioning is based on the identification of reference points between connection elements.

Figure 3 identifies five CEs for a mixed private/public B-ISDN overall connection type: the private access CE, the private transit CE, the public access CE, the public national transit CE and the public international transit CE.

4.2.2 Functional groups in the B-ISDN connection elements

In B-ISDN, the virtual path connection is introduced for routing groups of virtual channels in the network. Therefore two levels of connection handling will exist in the B-ISDN. These levels must be represented by two different switching blocks in the connection elements, one switching according to the virtual path identifier (VPI) and another switching according to the virtual channel identifier (VCI). Each of these switching blocks is under the control of its respective control block.

A general connection element model in B-ISDN is thus described using five functional blocks: a switching block for VPI, the S_{VPI}; a control block for VPI, the C_{VPI}; a switching block for VCI, the S_{VCI}, a control block for VCI, the C_{VCI}, and an interconnection link (see Figure 4). The link block incorporates all the functions implementing the physical layer. Different links may be identified, e.g. access links and transit links.



IRP Internal reference points (between connection elements)
CRF Connection related functions

FIGURE 3/I.327

Connection elements within an overall B-ISDN connection

In a particular reference configuration for connection types, the connection elements can be realized using a subset of the five functional blocks, for example to represent a connection in the network where only VPI handling is implemented.

4.2.3 B-ISDN connection element generic description

The generic B-ISDN connection element is shown in Figure 5. It represents the logical interrelationship between the functional blocks supporting the B-ISDN connections and the means to control the connections. The B-ISDN connection is supported by the links and the switching blocks S_{VPI} and S_{VCI}. The connections are controlled by the control blocks C_{VPI} and C_{VCI}. These control blocks logically interface to the user-network signalling system on the user side of an access connection element and with the internodal signalling network. For the control of semi-permanent connections, the control blocks also interface to the network management function. These management interface definitions will be the subject of further studies.

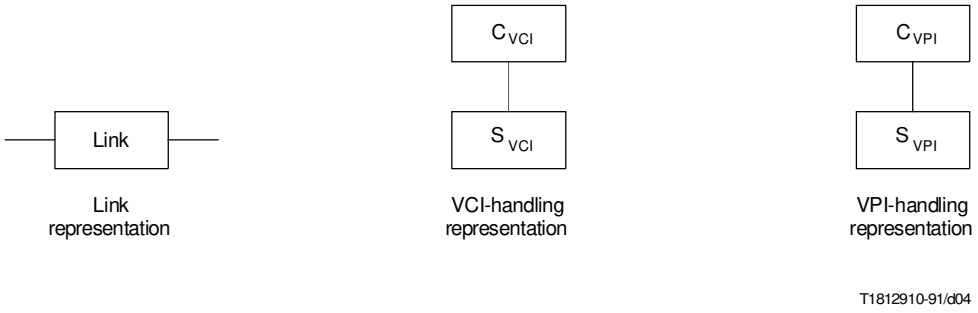
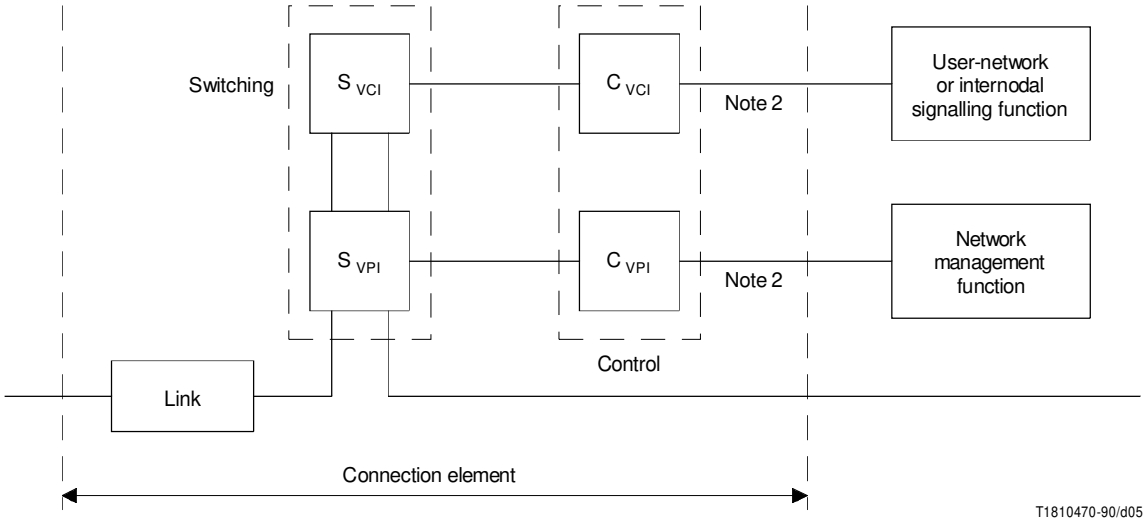


FIGURE 4/I.327

Functional groups in a B-ISDN connection element



NOTES

1 Figure 5 represents a generic connection element. The functional blocks may be combined into a single entity (e.g. S_{VPI} and S_{VCI} could be combined into a single ATM switching entity).

2 How the control block for VPI handling relates to signalling and network management functions is for further study.

FIGURE 5/I.327

A generic B-ISDN connection element (see Note 1)

4.3 Functional architecture models for the B-ISDN

Appendix I gives examples of functional architecture models using the principles established in Recommen-dation I.324. These principles are basically those of reference points and functional groups identified in Figure 8.

Annex A

(This annex forms an integral part of this Recommendation)

Recommendation I.211 identifies the connectionless data service aspects of B-ISDN. The transport of connectionless data units in B-ISDN is supported using the B-ISDN ATM switched capabilities between specific functional groups (connectionless services functions, CLSF) able to handle the connectionles protocol and to realize the adaptation of the connectionless data units into ATM cells. The CLSF functional groups may be located outside B-ISDN, in a private connectionless network or in a specialized service provider, or inside B-ISDN .

As a result, two mechanisms (in 2.7/I.211 for supporting connectionless data services are envisaged:

1) indirectly via a B-ISDN connection-oriented service (Case A),

2) directly via a B-ISDN connectionless data service (Case B).

The respective functional architecture models for Case A and Case B are representd in Figures A.1 and A.2. In case A, no constraints are imposed on the connectionless protocols to be adpted in the CLSF functional groups located outside B-ISDN, but suitable interfaces shall be recommended at he S_B or T_B and at the M reference points. In addition, Figure A.3 shows an example where Cases A and B coexist.

For the provision of the connectionless data service, ATM connections are to be established between the user and the CLSF and between CLSFs. These connections may be:

- semi-permanent virtual path connection (VPC); all the VC connections in these VP connections are dedicated to connectionless data service;
- a switched or semi-permanent virtual channel connections (VCC)[1)].

The CLSF, independently of its location, terminates the B-ISDN connectionless protocol and routes the connectionless data units towards a destination user according to addressing information included in the connectionless data units. The connectionless broadband data service on B-ISDN is described in Recommendation F.812.

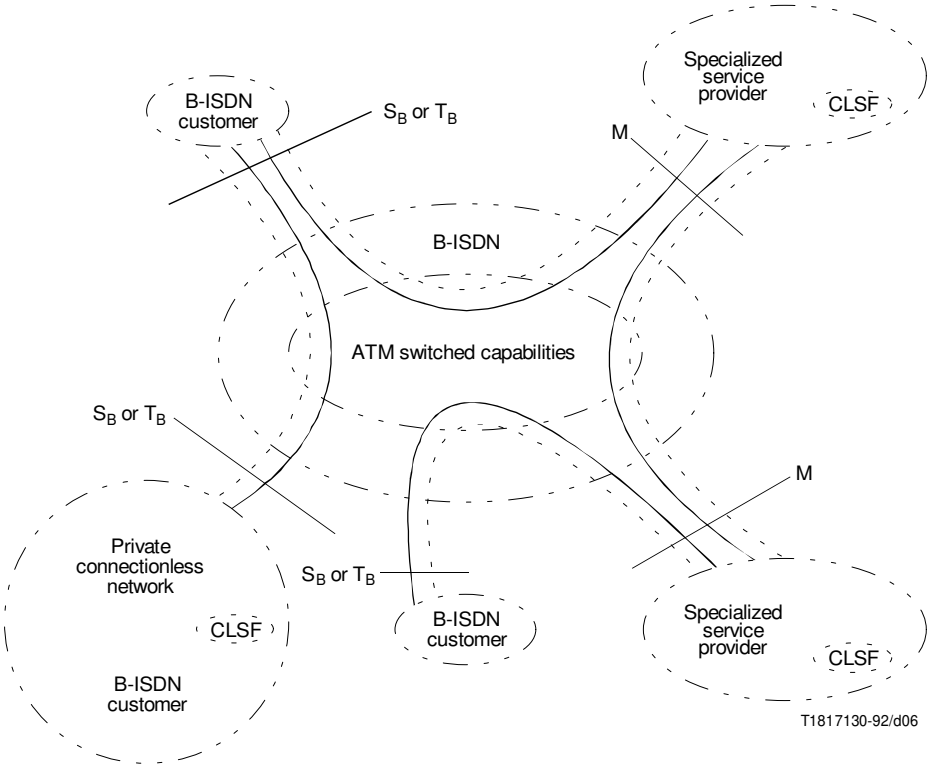
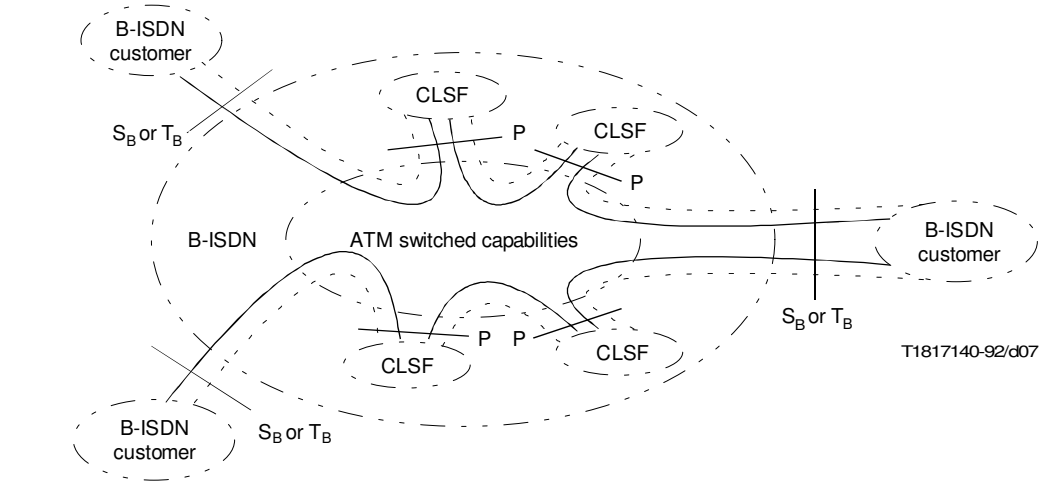


FIGURE A.1/I.327

Indirect provision of connectionless data service (Case A)

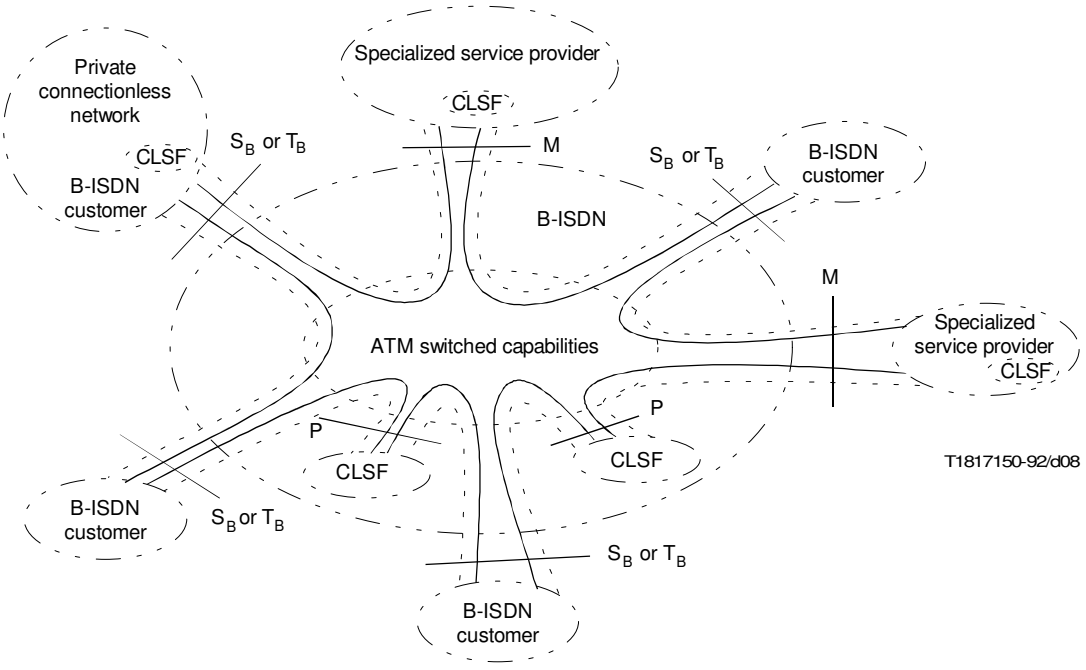
1) The use of semi-permanent or switched VCC between CLSFs shall be considered for consistency with other CCITT Recommendations currently under study.



———	Semi permanent connection
- - - - - - -	Call by call connection
CLSF	Connectionless service function
P, S, T	Reference points

FIGURE A.2/I.327

Direct provision of Connectionless Data Service (Case B)



———	Semi permanent connection
- - - - - - -	Call by call connection
CLSF	Connectionless service function
P, M, S, T	Reference points

FIGURE A.3/I.327

Example of coexistence of Cases A and B

Annex B

Alphabetical list of abbreviations used in this Recommendation

(This annex forms an integral part of this Recommendation)

ACE	Access connection element
AL	Access link
B-NT1	Network termination 1 for B-ISDN
B-ISPBX	Private branch exchange for B-ISDN
CBR	Constant bit rate
CE	Connection element
CLSF	Connectionless service function
CRF	Connection related function
DPL	Primary link for distribution services
IPL	Primary link for interactive services
IRP	Internal reference point
LE	Local exchange
LFC	Local function capabilities
LT	Line termination
NNI	Network-node interface
PLK	Primary link
RU	Remote unit
SP	Service provider
SPL	Service provider link
TCE	Transit connection element
TCRF	Transit connection related function
TE	Terminal equipment
VBR	Variable bit rate
VCI	Virtual channel identifier
VPI	Virtual path identifier

Appendix I

Examples for functional architecture models for B-ISDN

(This appendix does not form an integral part of this Recommendation)

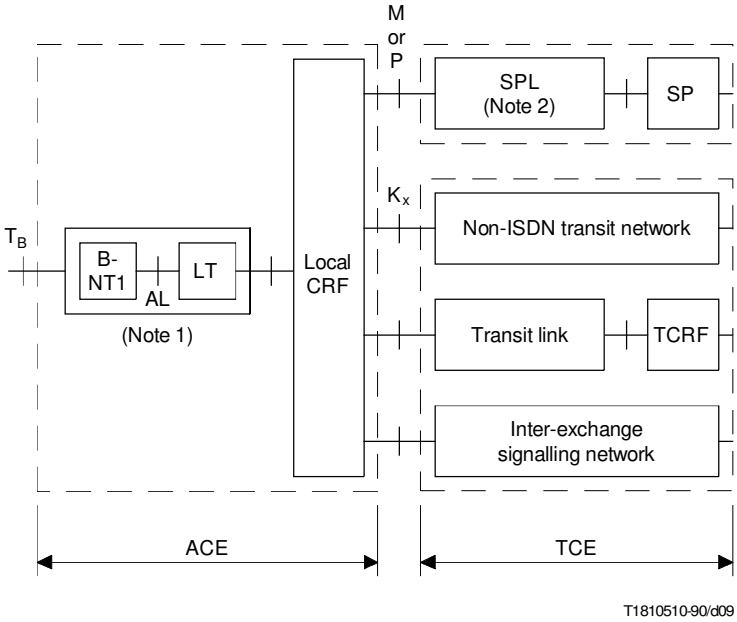
Functional architecture models aim to identify various possible physical arrangements for the realization of the network when interconnecting equipment. Depending on the national situations and on the type of access, a number of different functional architecture models exist for accessing the B-ISDN:

- a star structure where customers have direct individual links to the local exchange (LE) (see Figure I.1);
- a multistar structure with a remote unit (RU) between the customer and the main exchange. This is a two stage local network, each stage being star structured (see Figure I.2);
- a multistar structure, tree-shaped for distributive communication between the local exchange and the remote unit (see Figure I.3).

Other functional architecture models, such as metropolitan area networks, and access technologies such as passive optical network, are for further study.

NOTE – The passive optical network concept consists of a shared medium based on a tree topology that allows the connection of several customers to the local exchange using the same medium.

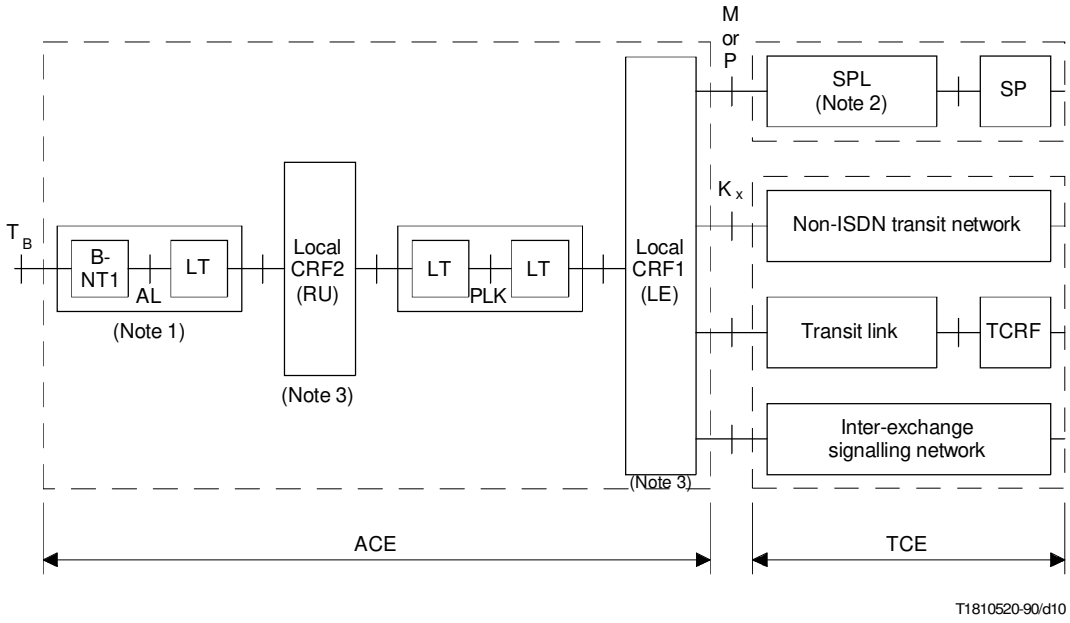
The metropolitan area network logical concept is based on a distributed (not centralized) local CRF. Customers have access to the network using a shared medium based on different topologies.



NOTE – Explanation of Notes and abbreviations is given in Figure I.3.

FIGURE I.1/I.327

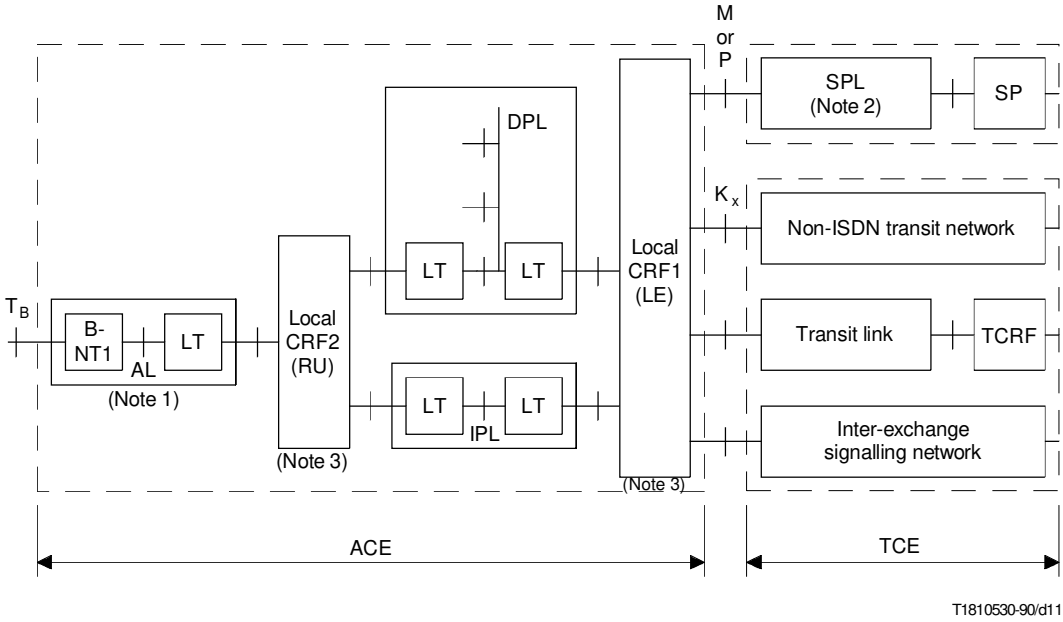
Architecture model using a star structured ACE



NOTE – Explanation of Notes and abbreviations is given in Figure I.3.

FIGURE I.2/I.327

Architecture model using a multistar structured ACE



ACE	Access connection element
AL	Access link
CRF	Connection related functions
DPL	Primary link for distribution services
IPL	Primary link for interactive services
LT	Line termination
RU	Remote unit
B-NT1	Network termination 1 for B-ISDN
PLK	Primary link
SP	Service provider
SPL	Service provider link
TCE	Transit connection element
K_x/M/P	Inter/Intra-network reference points
TCRF	Transit connection related function
LE	Local exchange

NOTES

1 AL: Access link. Multiplexers may exist on this link. In those cases, specific reference points have to be defined, not represented in these figures.

2 SPL: Service provider link. This link may be regarded as a transit link or as part of a special connection element.

3 CRF1 + CRF2 and CRF1´ + CRF2´ perform the same global functions as if only one CRF block existed.

FIGURE I.3/I.327

Architecture model using a multistar tree structured ACE