

Recommendation T/CAC S 10.1 E
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Formerly Recommendation T/SF 31-01 E

GENERAL ASPECTS OF AN INTEGRATED SERVICES DIGITAL NETWORK
(ISDN)

Recommendation proposed by Working Group T/GT 7 "Services and Facilities" (SF)
Amendments proposed by Project Team Service Descriptions for the ISDN (SDI)

Text of the Recommendation adopted by Commercial Action Committee (CAC)

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0. FOREWORD

An ISDN is a network providing end-to-end digital connectivity to support a wide range of telecommunication services. These services include voice and non-voice services to which customers have access by a small set of standard user-network interfaces.

CCITT

In the I-Series CCITT has prepared Recommendations which provide principles and guidelines on the ISDN concept as well as detailed specifications.

Based on these principles the European Commission has embarked on an European ISDN.

MOU

In 1989 a Memorandum of Understanding (MOU) on ISDN was agreed and signed by European network operators to enable European ISDN services to be offered across Europe in 1992. This includes a mandatory minimum set of services which all signatories will provide. This MOU requires:

- standards for a common range of services which all signatories will follow;
- standards for user-network interfaces and protocols having the objective of enabling any customer equipment implemented to the required standards to be connected to and operated with the ISDN provided by each party (terminal interchangeability);
- standards for interconnecting national systems in order to provide international services.

ETSI

The European Telecommunications Standards Institute (ETSI) has published or will publish both European Telecommunications Standards (ETs) or ETSI Technical Reports (ETRs) to specify or provide guidance on the services and standards for the European ISDN, thereby also taking into account the requirements of private networks (private ISDNs) which support identical or similar services to those of the public ISDN.

CEPT

The SF ISDN Recommendation, in general, is based on CCITT Recommendations, but as a target it should give guidance in the area of services descriptions as an European version of the CCITT Recommendation (without non-European options and with European priorities of services).

In the new edition of the SF ISDN Recommendation the additional target is to give guidance in the areas of service descriptions (operational requirements, etc.) to the relevant ETSI standardisation bodies (ETSI TCs, etc.) beyond the MOU ISDN services and priorities.

1. GENERAL

1.1. Services Design

That, in general, the design of services and the location of their features must aim to meet the service requirements in full, including maintenance, recognise the varying degrees of usage, and provide the service and supplementary service.

1.2. Evolution of ISDN

That the ISDN should be able to respond to new requirements quickly and at reasonable cost. The design should provide flexibility to meet foreseen requirements and take advantage of improved technology.

That the transition from an existing network to a comprehensive ISDN may require a period of time. During this period arrangements must be developed for the interworking of services on ISDNs and services on other networks.

That the evolution of the ISDN services should take into account the Intelligent Network (IN).

1.3. Commercial Benefits of the ISDN

That network operators may utilise the technical facilities of the ISDN to provide customers with one or more of a range of services via a common access point at their premises. This access point enables the user to use more than one service simultaneously.

That the range includes Bearer Services (T/CAC S 10.2), Teleservices (T/CAC S 10.3), and Supplementary Services (T/CAC S 10.5, 10.6 and 10.7).

That the ISDN is seen as a powerful service provision tool for network operators whose main commercial benefits appear to be:

- the ease and speed with which the composition of a given customer's package of Bearer Services can be altered from time to time to take account of changing needs;
- the ease and speed with which new types of Bearer Services can be offered to a customer once that customer is served by the ISDN;
- the expected improvement in quality of service on calls connected via the ISDN;
- the eventual attraction when ISDN penetration and availability is more general of being a subscriber to a service used by correspondents.

That the customer services that may be offered in the form of Bearer Services available at the network ("T") interface fall into the following groups:

- Leased point-to-point permanent circuits (accessed via 64 kbit/s, 384, or 1920 kbit/s);
- Access via 64 kbit/s, 384 kbit/s, or 1920 kbit/s to one or more of a number of switched services;
- Access via 64 kbit/s and 16 kbit/s to packet mode services;
- Access via broadband capabilities.

That the customer services that may be offered in the form of Teleservices from a common ISDN access fall into two groups:

- Leased Point-to-Point Permanent Circuits;
- Access to one or more of a number switched services.

Teleservices, however, include the terminal apparatus at the customer's premises and this apparatus may itself introduce a number of further variants in the presentation of the service to the customer.

1.4. Security

That for administrative security reasons, certain sensitive functions (e.g. charging, programming, traffic management) shall be located only inside premises or equipment that is physically secure from interference by persons other than authorised staff. This applies also from the remote access to a user network management service (e.g. performance monitoring and accounting management).

1.5. Charging

That the network operator shall have the ability to charge at the outset during and at the end of a call. Charging requirements may mainly be in accordance with the work done by the network when providing the service. This needs flexibility and typically requires:

- (a) processing cost
- (b) switching cost
- (c) transmission cost
- (d) signalling cost

as possible components of charging.

Note: The charging should include usage charges, which may include a call setup charge, a call duration charge, and facilities usage charges and may vary depending of time or day.

1.6. Testing

That the network should be able to prove remotely whether or not the network termination is in working order. It is also desirable to be able to remotely prove whether or not the user's terminal equipment is in working order.

1.7. Power Failure

That under conditions of local power failure at least one terminal on the basic access should be operational for basic telephony service. In addition, alarm (warning) transmission should also be possible under these conditions.

1.8. Provision, Removal and Withdrawal of Service

That the provision and removal of a service and the temporary withdrawal of a service under any conditions is covered by the individual service.

1.9. Physical Connection

1.9.1. *For Basic Access Terminals*

That the ultimate aim should be the standardisation of a universal socket allowing the connection of any type of terminal with the appropriate interface to the ISDN basic access.

1.9.2. *For Primary Rate Access Installations*

That the ultimate aim should be the standardisation of a universal socket installation allowing the connection of the appropriate interface to ISDN primary rate access.

1.9.3. *For ISPBX Terminals*

That the ultimate aim for connection of terminals to ISPBXs should be the adoption of the socket defined for basic access terminals.

1.10. Terminal Interchangeability

That the terminals connected to the ISDN basic access and behind the ISPBX should be

compatible.

Note: The principle of terminal interchangeability is to ensure that a terminal shall be (as far as possible) capable of participating in services independent of the actual network to which it is attached, i.e. different national ISDNs, private ISDNs, etc.

2. TYPES OF ISDN SERVICES

2.1. Service Types

Telecommunication services are divided into two broad families, i.e.:

- Bearer services, and
- Teleservices.

That a supplementary service modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a stand-alone service. It must be offered together with or in association with a basic telecommunication service. The same supplementary service may be common to a number of telecommunication services.

That the ISDN has to provide a minimum set of Bearer Services, Teleservices, and Supplementary Services (see Fig. 3).

2.2. Bearer Services

That a set of internationally standardised bearer services should be offered by network operators. A list of bearer services is given in Recommendation T/CAC S 10.2. See also CCITT Recommendation I.230.

Note 1: The multiplexing of multiple subrate information streams made by users are on their own responsibility.

Note 2: The circuitmode bearer services are typically characterised by provision of user information over one type of channel and signalling over another type of channel. The packetmode bearer services involve packet handling functions.

2.3. Description of Bearer Services

Bearer services are fully described by prose definitions and descriptions which all together define the service characteristics as they apply at a given reference point where the customer accesses the service. CCITT Recommendation I.140 and I.210, Annex B, describe the use of attributes for this purpose.

2.4. Teleservices

That a set of international standardised teleservices should be offered by network operators. A list of standardised teleservices is given in Recommendation T/CAC S 10.3. See also CCITT Recommendation I.240.

2.5. Description of Teleservices

Teleservices provides the full capacity for communication by means of terminal and network functions. CCITT Recommendation I.210, Annex C, describes the use of attributes for this purpose.

2.6. **Supplementary Services**

That an agreed list and agreed definitions of supplementary services, the relevance of supplementary services to bearer and teleservices, and the agreed operational requirements of ISDN supplementary services are given in Recommendation T/CAC S 10.5, 10.6, and 10.7.

2.7. **Commonality between Public and Private ISDN Services**

As a basic objective the standardised ISDN services should be designed to cover both public and private ISDN requirements.

2.8. **Introduction of New Services**

That the introduction of new services should not prejudice telephony or cause any significant penalties to be incurred by the major services in the network.

3. **USER INTERFACES (EXCLUDING ISPBXs)**

3.1. **Basic Access Capabilities**

That for the basic access the capability of carrying at least 2 simultaneous calls should be provided. These may use one or more channels provided exclusively for the transfer of user information and a channel whose primary use is for user-to-network signalling.

That the both-way signalling system between the user's premises and the network shall be adequate to support existing services and also provide the capability of introducing new services on the basic access without adversely affecting the existing or new services.

That the user should be given the possibility to ascertain the state of his access channels, for instance whether a channel is busy or whether a channel is allocated to a particular service. This may be provided automatically.

That the user should be able to employ his access to the network for the operation of one or more terminals of either the same or different types either sequentially or simultaneously, using the same links between his premises and the local switching node. The number may be restricted by the number of parts on the network termination.

3.2. **Connection of More than One Terminal**

That it should be possible to connect any mixture of terminals up to a maximum of eight terminals to the same basic access.

3.3. **Electrical and Protocol Characteristics**

3.3.1. *Basic Rate Access*

That one interface (the S/T interface) exhibiting standardised electrical and protocol characteristics shall be adopted for the ISDN basic rate access (2 B + D).

Note 1: It is recognised that network operators may wish to offer other standardised interfaces via terminal adapters, e.g. X.21, X.25, V series, analogue telephony, telex for an interim period in order to make

ISDN attractive to users.

Note 2: Attachment requirements are contained in NETs (Normes Européennes de Télécommunications). NETs are common technical regulations and as such of an obligatory nature.

3.3.2. *Primary Rate Access*

That one interface exhibiting standardised electrical and protocol characteristics shall be adopted for the ISDN primary rate access (30 B + D).

The primary rate access interface should permit any number of channels between 1 and 30 channels. The upper limit of channels of a primary rate access is 30. Only one signalling channel is specified.

3.3.3. *Open Network Provision (ONP)*

That ONP conditions shall apply at the S/T reference point (for basic rate access and primary rate access).

3.4. **User Equipment End-to-end Capabilities**

That user equipment should provide end-to-end protocol capabilities for the bearer and teleservices.

4. **CALL HANDLING PROCEDURES**

4.1. **User Control Procedures**

That it should be possible to set up, clear down and manipulate calls separately on each channel.

That in the long term and where services make use of network based resources, a common user control procedure shall apply to services and supplementary services as far as is practicable.

That it should be recognised that the existing control procedures for services and supplementary services (as described in the Recommendations T/CAC O 2 (T/SF 2) and T/CAC S 10.7, and appropriate CCITT Recommendations) should be retained for an interim period. However, new control procedures designed to take advantage of the ISDN's separate channel signalling capability should be defined for all existing services.

4.2. **Priority**

4.2.1. *Incoming Calls*

That an incoming call be afforded priority under call collision conditions. (It is assumed that adequate measures such as time-outs will be available to avoid malicious blocking problems.)

4.2.2. *Outgoing Calls*

That in the case of outgoing calls the network should not offer priority of one service over another, unless this is specifically requested by the user or network operator, in which event it shall remain under the control of the network operator.

4.3. **Auto Repeat Attempts**

That where call data is stored at a terminal and calls (to the same destination) are initiated at a later time, the automatic repeat call facility shall be limited as agreed by individual network operators.

In order to minimise increasing congestion in the network it is desirable that the network shall be able to protect itself against uncontrolled auto repeat call attempts, for example by the use of an appropriate charging method.

4.4. **Validation of Network Requests**

That the ISDN should validate all signals that affects the handling of a call within the network, e.g. *basic call demands, supplementary services demands, activation/deactivation, and call release.*

5. **CHANNEL ALLOCATION**

5.1. **Subscriber Control of Channel Allocation**

That network operators shall be able to allow users to exercise some options over the ISDN channel allocations made in relation to traffic type and direction, but the network operators should control at least the technical function of signalling and channel allocation of the ISDN interface.

5.2. **Rules for Channel Allocation**

That rules should be applied to channel allocation, and these may not be identical for both incoming and outgoing traffic on the same access;

That the general rules should be:

- 1) the operation of the rules should not restrict unduly the quantity of traffic that a user can offer to the network;
- 2) the operation of rules should not allow the completion of incoming calls to be unduly obstructed.

That users should be able to choose options within the channel allocation rules, e.g. to take account of time periods or variations of terminal equipment.

That the network operators should be able to gain access to a record of all changes to channel allocation for network operation and maintenance. However, whilst the mechanism that controls channel allocation should be owned and controlled by the Network Operator.

6. **NUMBERING, ADDRESSING, AND SERVICE INDICATION ASPECTS**

6.1. **Numbering Aspects**

That each network termination should be selected by one subscriber number both in cases of ISDN basic access and also for primary rate ISDN access.

6.2. Terminal Addressing/Selective Calling

That where a number of terminals of the same or different type(s) are supported on the same ISDN access, selective calling of individual terminals is supported by the following supplementary services:

- Direct Dialling In (DDI)
- Multiple Subscriber Number (MSN)
- Sub-Addressing (SUB)

From a functional viewpoint all three can be regarded as achieving the same effect. However DDI is part of the numbering scheme and its use must conform to the rules of the numbering scheme. Sub-addressing is not part of the numbering scheme and the need for standardisation of this facility is dependent on its use. Multiple Subscriber Number is very restrictive as its use is only available for up to eight terminals on an ISDN basic access.

6.3. Service Indicators/Information Elements

That the selection of bearer service is performed by means of the information element Bearer Capability (BC).

The information elements are used on outgoing calls to select an appropriate standardized bearer service. For incoming calls terminals shall use different information elements to ascertain whether or not a call is appropriate and hence whether to select it or not (terminal compatibility checking).

Note: The following information elements were defined:

- Bearer Capability (BC)
- Low Layer Compatibility (LLC)
- High Layer Compatibility (HLC)

6.4. Availability of Services

That some network operators may wish that the availability of services supported by a particular subscriber number should be indicated in a directory.

6.5. Network Interworking Arrangements

That the intercommunication/interworking of services (including supplementary services) with services in other networks (to other national ISDNs via international gateways, to private ISDNs, to PLMNs, etc.) which support identical or similar services to those of the ISDN is a basic requirement.

6.6. Interworking Numbering Arrangements

That the use of an integrated addressing scheme to cover interworking with existing national networks must be considered as a national matter.

6.7. End-of-Address Message

That the network should be capable of recognising an "end-of-address" message if one is received. For the basic telephony service, no special "end-of-address" message signal should be required other than any arising from logical development in telephony terminals,

e.g. display sets with send buttons.

7. DEFINITION OF BUSY IN AN ISDN

7.1. Scope

This section describes the conditions under which a given ISDN destination is considered busy. In general, this occurs whenever the resources associated with that destination (and needed to successfully complete the call) exist but are not available for that call. In existing networks, such as the PSTN, this is indicated to the calling subscriber by busy tone. In addition, the operation of certain ISDN supplementary services occurs, when certain of these resources are busy. Therefore, these resources busy conditions are also described herein.

This section does not cover the cases where network resources not associated with a given destination are unavailable, or when such resources are out of service or otherwise non-functional.

7.2. Resource

Two main categories of resources may become involved in the determination of busy: (a) interface resources and (b) customer resources.

- (a) Interface resources include the signalling channel (D-channel), other physical channels (B- and H-channel), logical channels (for packet mode services) and the maximum number of calls supported. It is noted that with the ongoing activities on calls versus connections other interface resources may become important in the future.

For the purposes of this Recommendation, the signalling channel is considered always to be available and with sufficient capacity to handle signalling for new calls. Situations where this is not true are considered to be failure conditions and are not covered here. For the other interface resources descriptions are given below of what is meant when they are considered busy.

- (b) Subscriber resources include the terminal(s) and the persons or processes using them. For the purposes of this Recommendation, it is not considered significant which of the subscriber resources are busy, or why. An indication from the subscriber that subscriber resources are busy is sufficient.

7.3. Resource Busy Conditions

Three resource busy conditions have been found necessary to refer to and are defined below:

Channels busy:

This condition occurs when there is no appropriate information channel (physical or logical) available for the network to use for the call.

Maximum number of calls reached:

This condition occurs when the maximum number of calls supported at the given subscriber's interface(s) has been reached.

Subscriber busy:

This condition is indicated by the subscriber's terminal equipment, e.g. by having all compatible terminals which could respond to the call request indicate user busy either

when they are offered a call, or in response to an enquiry from the network.

7.4. Procedural Aspects

The resource busy conditions described above significantly influence call offering procedures, both for the basic ISDN calls and for calls that may involve ISDN supplementary services. The procedural aspects of call offering are outlined below and shown in Figure 4 (T/CAC S 10.1).

1. Assume that a call of a telecommunication service subscribed to by the called subscriber is about to be offered.
2. If all the appropriate user-network interface information channels are busy (i.e. channels busy) and either the network does not support the offering of additional calls beyond the number of appropriate channels, or the maximum number of such additional calls has been reached, the network will clear the call (see also subclause 7.4.7. below) and indicate Network Determined User Busy (NDUB) back towards the calling subscriber.
3. Similarly, if the maximum number of calls supported at the given subscriber's interface(s) has been reached, the network will clear the call (see also subclause 7.4.7. below) and indicate NDUB back towards the calling subscriber.
4. Otherwise, the network offers the call to the subscriber.
5. If any compatible terminal responds positively to the call offering, i.e. gives some indication that the call may progress towards successful completion, the normal call offering procedures should continue.
6. If no terminal responds positively but one or more terminals responds user busy then, when the response-to-call-offering time-out occurs, the network will clear the call with the indication User Determined User Busy (UDUB).
7. It is recognised that for the determination of a NDUB condition, the network does not assume any knowledge of whether or not a compatible terminal exists at the called interface. This may mask the determination of a no compatible terminal available condition, i.e. a NDUB condition may be returned when, in fact, no compatible terminal is connected. The use of an explicit compatibility check to prevent this from occurring is a network operator option.

7.5. Definition of Busy

An ISDN destination is considered to be busy if either a Network Determined User Busy or a User Determined User Busy condition occurs as described above.

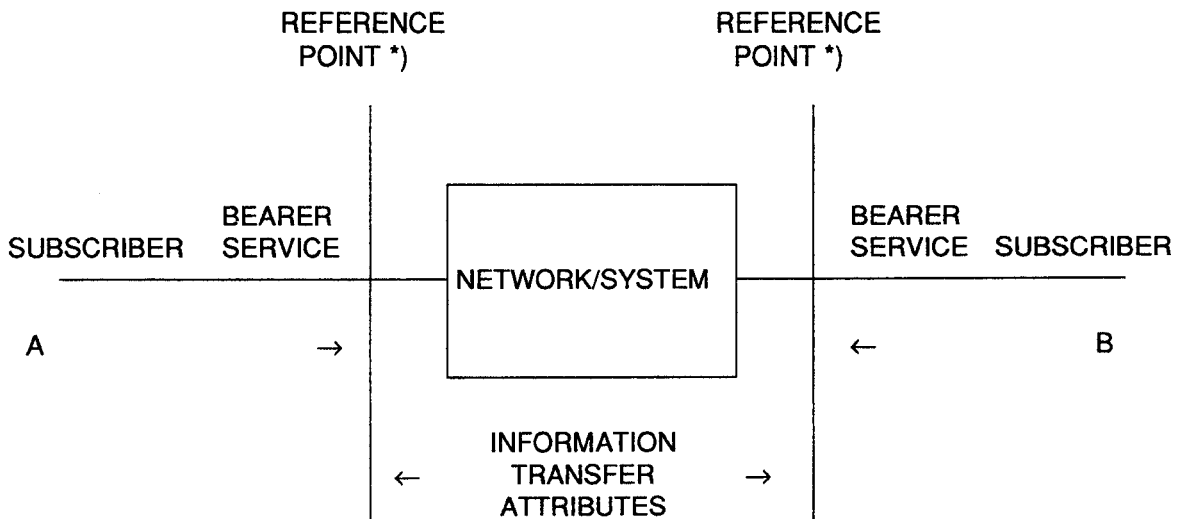


Figure 1 (T/CAC S 10.1). Bearer Service Attributes.

Access Attributes are defined at reference point. They can be different on the A or B side.
Information Transfer Attributes are defined between reference points.
General Attributes are used to define other aspects of bearer service; they are not defined at or between reference points.
 *) In the case of the ISDN, the reference point will be in the S/T interface. In other cases, the reference point need to be defined, but in general it will be the interface between the network and the terminal.

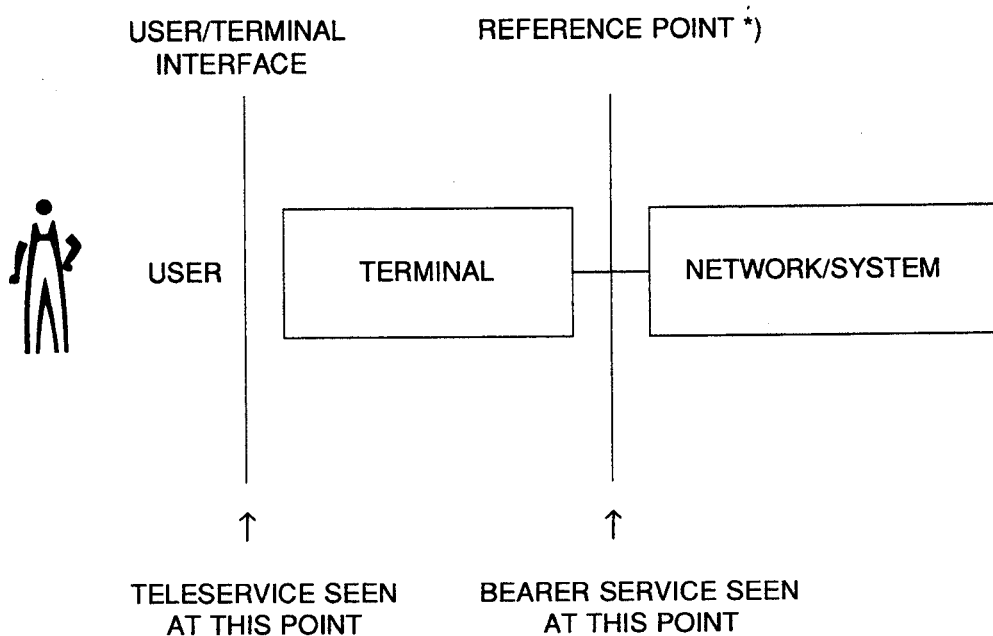


Figure 2 (T/CAC S 10.1). Differences between Bearer Services and Teleservices.

*) In the case of the ISDN, the reference point will be the S/T interface, in other cases, the reference points need to be defined, but in general terms they will be the interface between the network and the terminal.

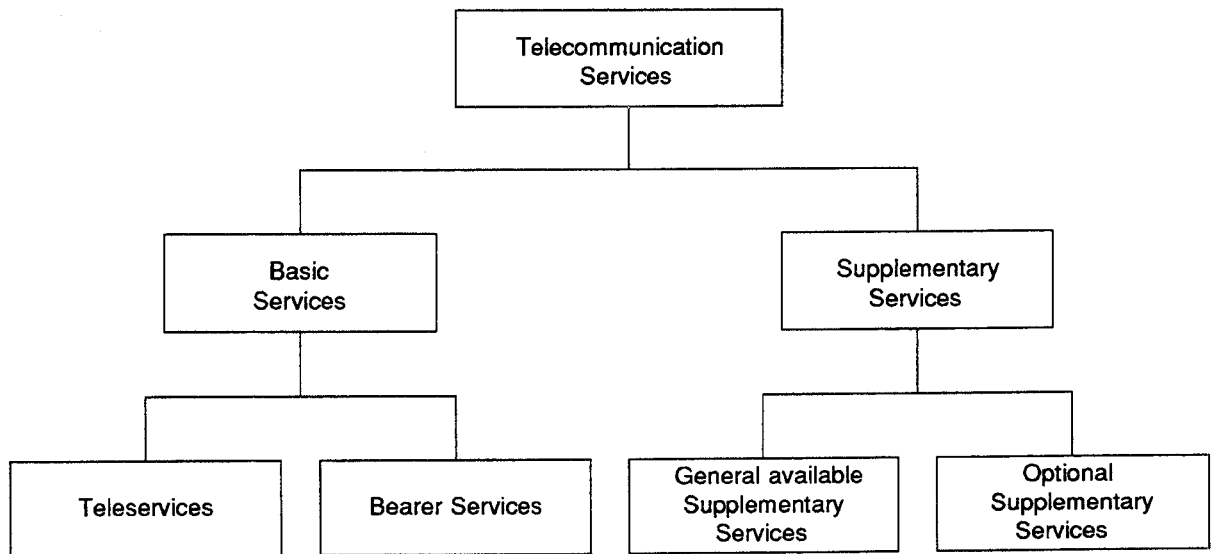


Figure 3 (T/CAC S 10.1). Inter-relationship of Services.

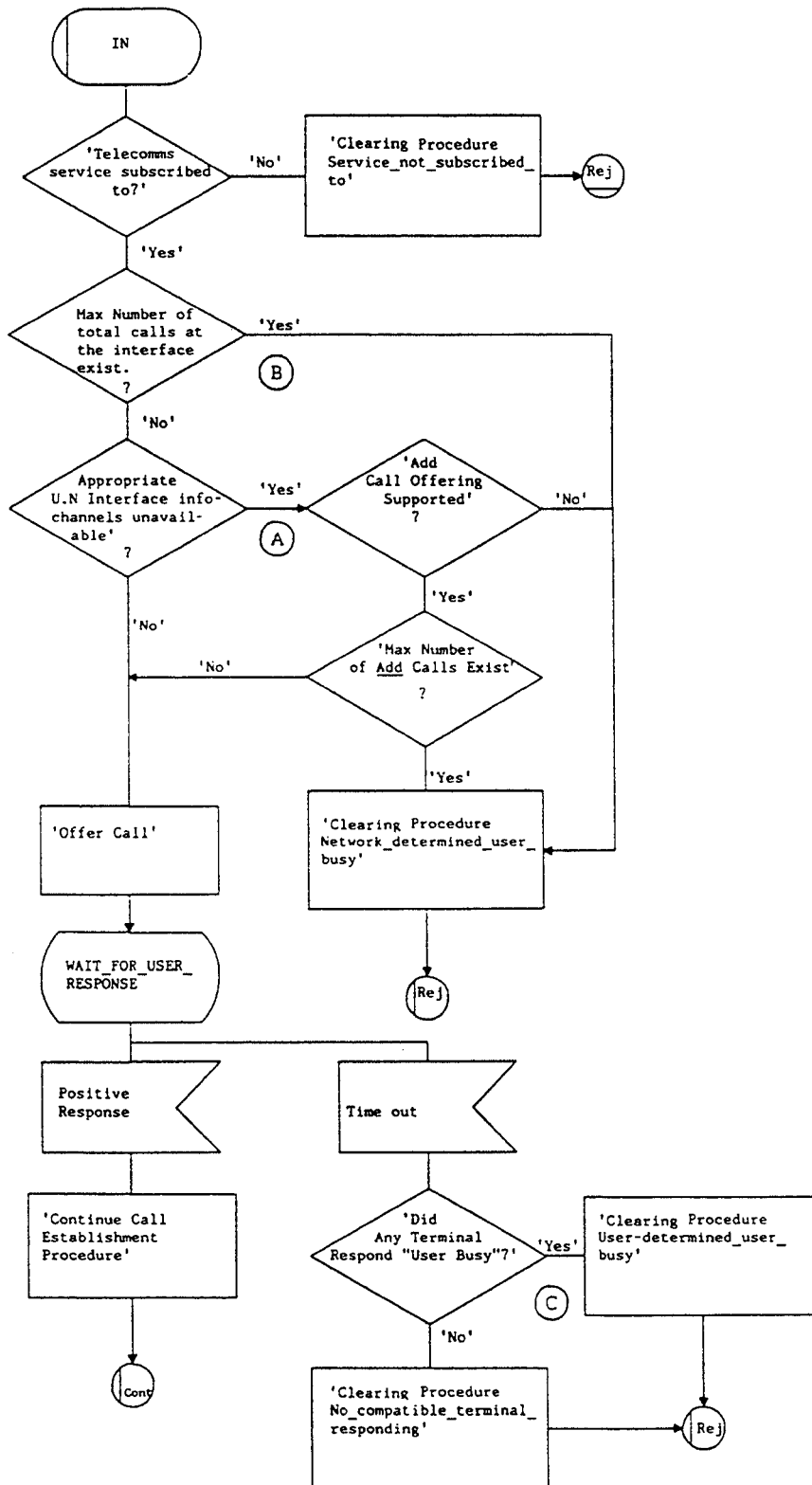


Figure 4 (T/CAC S 10.1). Procedural Aspects of Call Offering.

Notes to Figure 4 (T/CAC S 10.1).

Note 1: This figure illustrates the procedural aspects and the situations which give rise to a clearing procedure containing user busy information. It does not attempt to define any signalling protocol or the design of a network.

Note 2: Point (a), (b) and (c) have been identified to assist in the description of ISDN supplementary services.

Note 3: The capability to support additional call offerings may involve the use of a supplementary service.