Recommendation T/SF 31-01 (Cannes 1983, revised in Odense 1986)

GENERAL ASPECTS OF AN INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

Content

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. Flexibility of ISDN Design

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.

1.3. Commercial Benefits of the ISDN

1.3.1.   That Administrations may utilize the technical facilities of the ISDN to provide customers with one or more of a range of services via common access point in their premises. This access point offers the capability to permit the use of more than one service simultaneously.

1.3.2.   That this range includes services presented as both Bearer and Teleservices, but Administrations will normally choose whether to offer customers a particular facility in the form of a Bearer Service, a Teleservice or both.

1.3.3.   That the ISDN is seen as a powerful service provision tool for administrations 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.

1.3.4.   That the customer services that may be offered in the form of Bearer Services available at the network ("T") interface fall into two 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.

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

— Leased Point-to-Point Permanent Circuits;

— Access to one or more of a number of switched services.

Teleservices, however, include the terminal apparatus at the customer 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 administration staff.

1.5.   Charging

That the administration shall have the ability to charge at the outset, during and at the end of a call. Charging requirements may be mainly in accordance with the work done by the network in 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.

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. For further SF study.

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 service and the temporary withdrawal of 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 standardization of a single universal socket allowing the connexion of any type of terminal with the appropriate interface to the ISDN basic access.

1.9.2.   *For ISPBX Terminals*

That, where administrations are able to do so, the ultimate aim should be the standardization of the same socket for connexion of terminals connected to ISPBXs.

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

2.   TYPES OF ISDN SERVICES

2.1.   Service Types

That the ISDN shall provide a set of Bearer Services and a range of Teleservices. The ISDN should also provide Supplementary Services.

Standardized Teleservices are listed in Recommendation T/SF 31-02.

2.2. Bearer Service

That a set of internationally standardized Bearer Services should be offered by administrations. A list of Bearer Services is given in Recommendation T/SF 31-02.

The Circuit-mode bearer services are typically characterized by the provision of user information over one type of channel and signalling over another type of channel. The packet-mode bearer services involve packet handling functions.

Note: The multiplexing of multiple sub-rate information streams made by users are their own responsibility.

2.3. Description of Bearer Services

Bearer Services are described by a number of attributes. These attributes are described and defined in CCITT Recommendation I.211.

2.4. 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

3.1.1. 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.

3.1.2. That the bothway 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.

3.1.3. 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.

3.1.4. That the user should be able to employ his access to the network for the operation of one or more teminals of either the same or different type 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

3.2.1. That it would be possible to connect up to any mixture of terminals up to a maximum of 8 terminals to the same basic access.

3.2.2. That for voice communication it should be possible for up to 2 telephone terminals at each destination to be used by the same call.

3.2.3. That for the connexion of more than one non-voice terminal to be used on the same call further study is required.

3.3. Electrical and Protocol Characteristics

3.3.1. *Basic Access*

That one interface (the "S/T" interface) exhibiting standardized electrical and protocol characteristics shall be adopted for the ISDN Basic Access.

Note: It is recognised that administrations may wish to offer other standardized interfaces vice Terminal Adaptor e.g. X.21, X.25, standardized interfaces vice Terminal Adaptor e.g. X.21, X.25, V Series, analogue telephony, telex for an iterim period in order to make ISDN attractive to users.

3.3.2. *Primary Rate*

That one interface exhibiting standardized electrical and protocol characteristics shall be adopted for the ISDN Primary Rate Access. The Primary Rate Access interface should permit:

— any number of subscriber channels from a small number (greater than one to be agreed by administrations) but with no upper limit;

— one or more signalling channels as dictated by traffic characteristics.

3.4. Terminal Intercommunication

That it is desirable to be able to communicate between terminals connected to the same network termination without placing a call towards the public network.

4. CALL HANDLING PROCEDURES

4.1. User Control Procedures

4.1.1. That it should be possible to set-up, cleardown and manipulate calls separately on each channel.

4.1.2. 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 praticable.

4.1.3. That it should be recognised that the existing control procedures for Services and Supplementary Services (as described in the SF Handbook and appropriate CCITT Recommendations) should be retained for a 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.

4.1.4. That the administration shall have the option to introduce the new control procedures for all customers co-incident with the opening of an ISDN exchange which would, for example, provide the opportunity to show the ISDN to its best advantage.

4.2. Priority

4.2.1. 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 administration , in which event it shall remain under the control of the administration.

4.2.3. That terminals providing for more than one service shall not offer a priority of one service over another, for calls unless this is specially requested by the user or the administration, in which event it shall remain under the control of the administration.

4.3. Incoming Calls to a Locally Busy Terminal

That where a terminal is not in use on an outgoing call, but is in use on some local task for the user, an incoming call should be treated by the user's terminal as follows.

4.3.1. *Voice Terminal*
An incoming call should normally not be allowed to interrupt the local task, but an indication that there is an incoming call waiting may be given.

4.4. Auto Repeat Attempts

4.4.1. 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 to make up to 4 calls at intervalls as agreed by individual administrations. A preferred method of meeting this requirements would be to utilise the Completion of Calls Meeting Busy service.

4.4.2. 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. Other methods are for further study.

4.5. Validation of Network Requests

That the ISDN should validate all signals that affect the handling of a call within the network, e.g. Basic Call Demands, Supplementary Services Demands, Activation/Deactivation and Call Release.

4.6. Change of Service During an Established Call

That it should be possible to change between the service offered by administrations during an established call. Whether this applies to Bearer and/or Teleservices requires further study.

Note: In the case of Bearer Services it should be recognised that, at least in the early stages of ISDN, it is likely that declaration of the intention to change services during a call, before the call is made, will be required for technical reasons. However, when this is available, the following should occur during or after an attempt change.

(a) the original service not be disconnected before the substituting service is available;

(b) the user should receive a suitable indication when the required service is available;

(c) the user should receive a suitable indication when the required service is not available.

4.7. **Sequential changes between Services**

That where a sequential change from one service to another is required this should be possible at any time during the progress of the call. However, during the early stage of ISDN when ISDN and existing networks are interworking, the subscriber will be required to indicate the possibility of a sequential change from one service to another at the time of the call set-up by means of a request for a suitable Bearer Service.

5. **CHANNEL ALLOCATION**

5.1. **Subscriber Control of Channel Allocation**

That administrations shall be able to allow users to exercise some options over the ISDN channel allocations made in relation to traffic type and direction but administrations should control at least the technical function of signalling and channel allocation in subscribers premises served by an ISDN;

5.2. **Rules for Channel Allocation**

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

5.2.2. That the General Rules should be:
   i) the operation of the rules should not restrict unduly the quantity of traffic that a user can offer to the Network;
   ii) the operation of rules should not allow the completion of incoming calls to be unduly obstructed;
   iii) the administration should apply standard rules for channel allocation. This would be part of the access and should be included in the basic charge for access to an ISDN.

5.2.3. 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;

5.2.4. That administrations 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 administration.

6. **RATE ADAPTION**

6.1. That low speed traffic should be sent and received on any channel according to the channel allocation rules mentioned above;

6.2. That rate adaptors on user's premises should conform to the requirements of Recommendations T/SF 13 and T/SF 13-01.

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

7.1. **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.

7.2. **Selective Calling**

That where a number of terminals of the same or different type are supported on the same ISDN access, selective calling of individual terminals is required in many cases.

Note: Three methods of achieving selective calling have been identified:
Direct Dialling In (DDI).
Sub-Addressing.
Terminal Selection.

From a functional viewpoint all 3 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 standardization of this facility is dependent on its use. Terminal Selection is very restrictive as its use is only available for up to 8 terminals on an ISDN Basic Access.

7.3. **Service Indicators**

That the selection of an Individual Standardized Bearer Service should be performed by means of service indicators. Service Indicators are the means of identifying particular services and should be provided automatically.

Service indicators are used on Outgoing Calls to select an appropriate Standardized Bearer Service. For Incoming Calls terminals shall use service indicators to ascertain whether or not a call is appropriate and hence whether to select it or not.

7.4. **Availability of Services**

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

7.5. **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, but should be studied for the purpose of possible harmonization.

7.6. **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 developments in telephony terminals e.g. display sets with "send" buttons.

8. **DEFINITION OF BUSY IN AN ISDN**

8.1. **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.

8.2. **Resources**

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-channels), logical channels (for packet mode services) and maximum number of calls supported. It is noted that with the ongoing activities on "calls vs connections" other interface resources may become important in the future.

For the purposes of this Recommendation, the signalling channel is considered to be always 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) themselves 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 (some, necessary) subscriber resources are busy is sufficient.

8.3. **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.

8.4. Procedural Aspects

The resource busy conditions described above significantly influence the call offering procedures, both for the basic ISDN calls and for call that may involve ISDN supplementary services. The procedural aspects of call offering are outlined below and shown in Figure 4 (T/SF 31-01).

1. Assume that a call of a Telecommunications Service subscribed to be 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 paragraph 3.1.6. below) and indicate "Network Determined User Busy" 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 paragraph 3.1.6. below) and indicate "Network Determined User Busy" 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 respond "User Busy" then when the response-to-call-offering timeout occurs, the network will clear the call with the indication "User Determined User Busy".
7. Although beyond the scope of this Recommendation, it can be noted that since every compatible terminal is required to respond in some way to an incoming call offering (Recommendation ...), if no terminal responds before the above timeout occurs the network may clear the call with the indication "No Compatible Terminal Responding".

8.5. 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.

8.6. Open Issues

It is recognized that for the determination of a "Network Determined User Busy" (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, is 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 Service Provider option and is for further study. When a service provider makes available this option the user selects, at subscription time, whether or not this function is performed at his interface.

Notes to Figure 4 (T/SF 31-01)

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. Items shown in dashed boxes do not lead to a busy condition; they are shown for completeness.

Note 3. Points (a), (b) and (c) have been identified to assist in the description of ISDN supplementary services.

Note 4. The capability to support additional call offerings may involve the use of a supplementary service.

REFERENCE
POINT*

REFERENCE
POINT*

SUBSCRIBER

BEARER
SERVICE

NETWORK/SYSTEM

BEARER
SERVICE
←

SUBSCRIBER
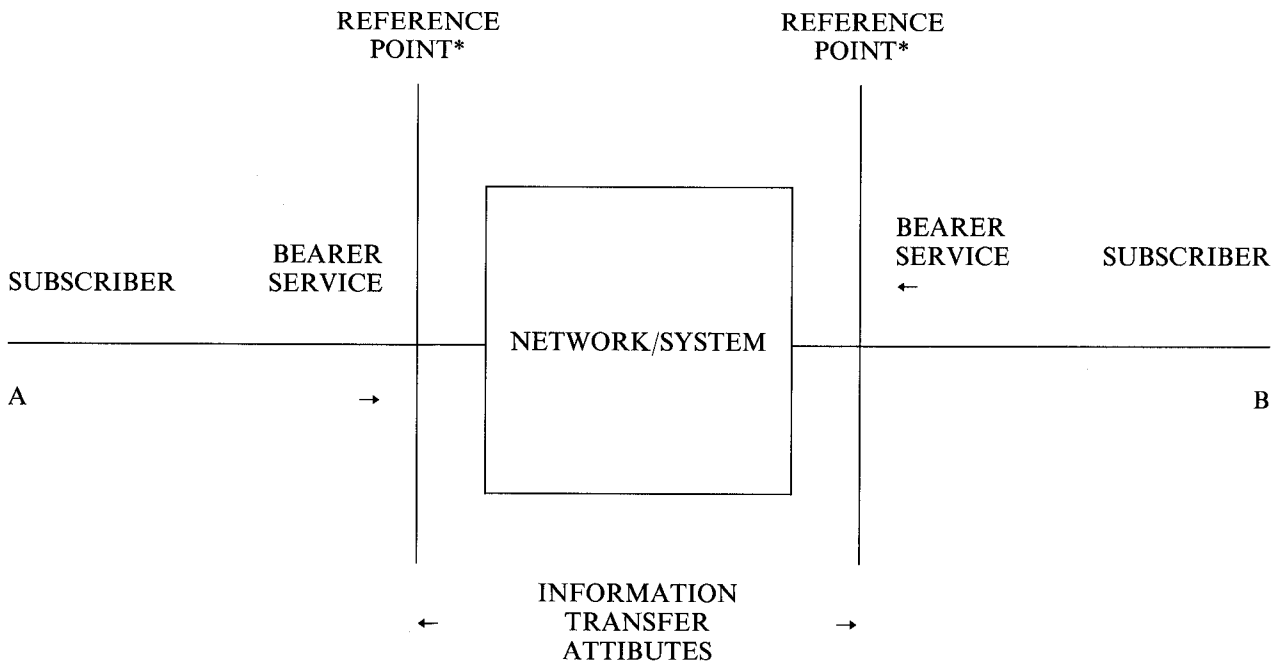
A

→

B

←

INFORMATION
TRANSFER
ATTIBUTES

→

Figure 1 (T/SF 31-01).   Bearer Service attributes.

Access Attributes are defined at Reference Points. They can be different on the A or B side.

Information Transfer Attibutes are defined between Reference Points.

General Attributes are used to define other aspects of Bearer Services; they are not defined at or between Reference Points.

*Note: In the case of the ISDN, the Reference Point will be in the S/T interface. In other cases, the Reference Points need to be defined, but in general will be the interface between the Network and the Terminal.

USER/TERMINAL
INTERFACE

REFERENCE POINT*

USER

TERMINAL

NETWORK/
SYSTEM

↑
TELESERVICE SEEN
AT THIS POINT
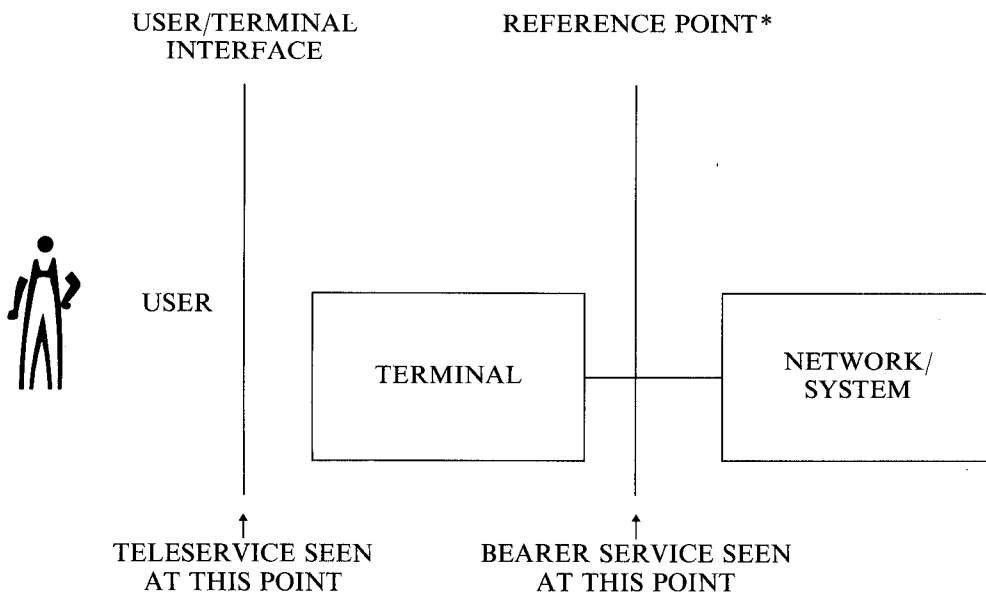
↑
BEARER SERVICE SEEN
AT THIS POINT

Figure 2 (T/SF 31-01).   Illustrating the essential difference 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 will be the interface between the Network and the Terminal.
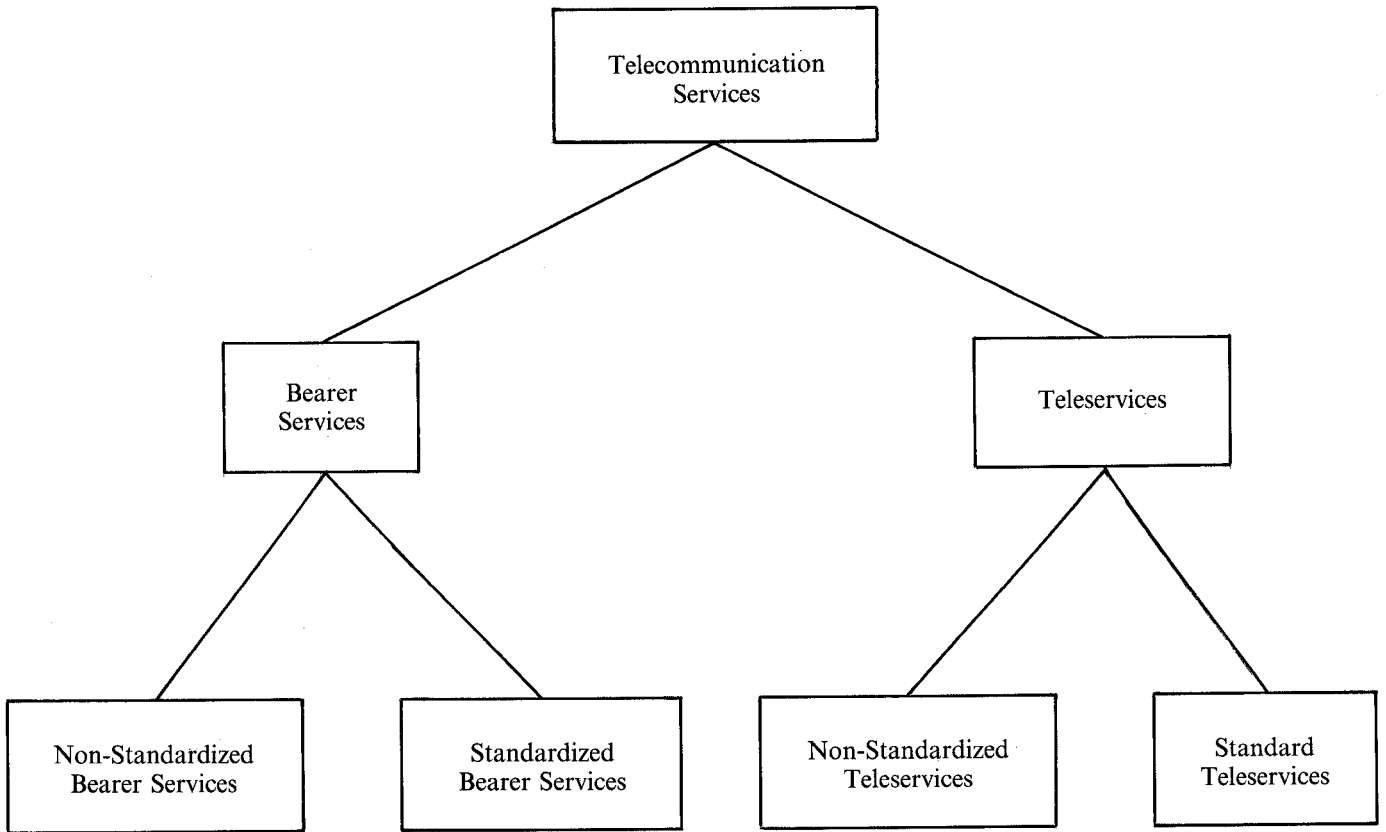
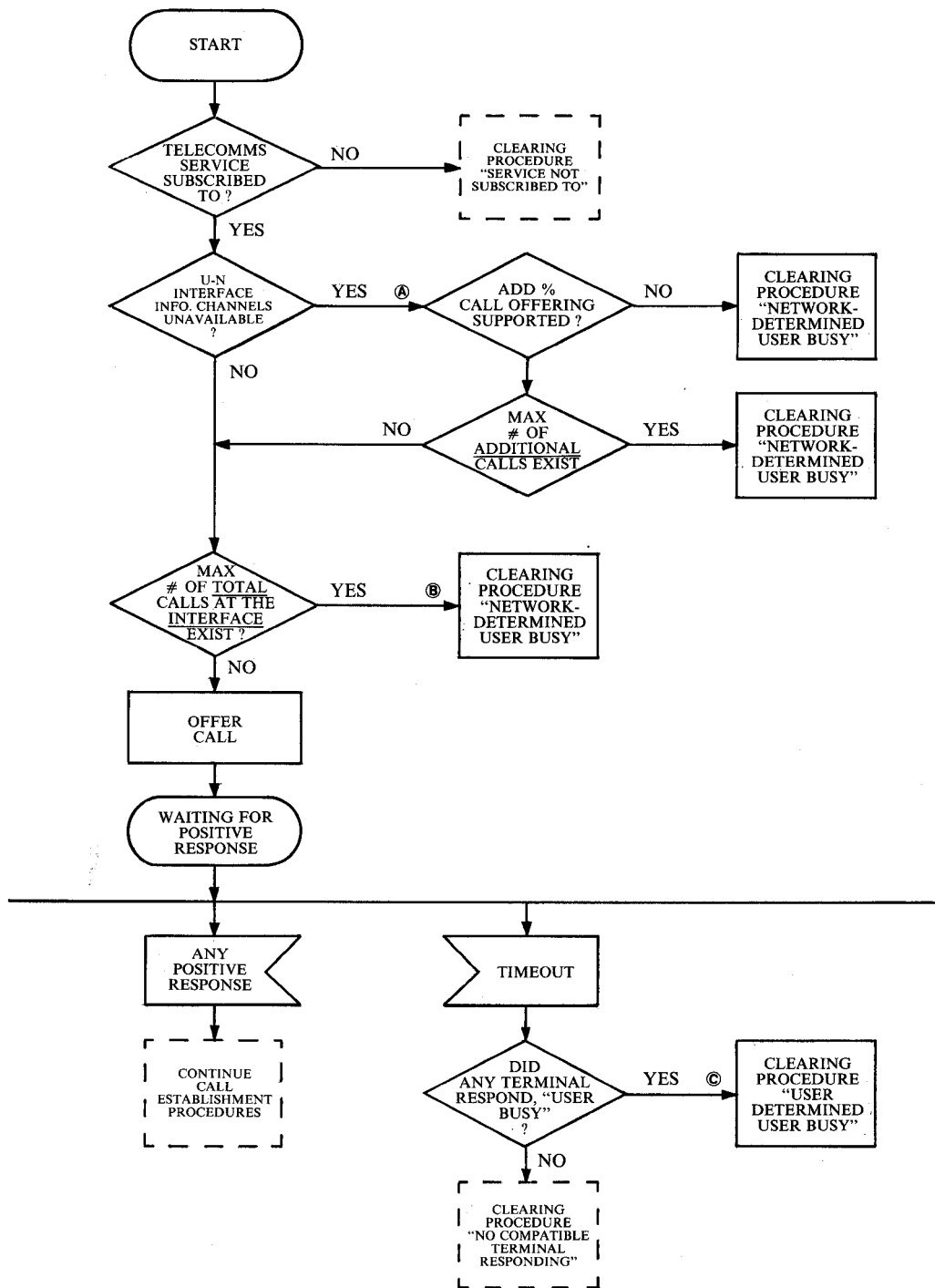Figure 3 (T/SF 31-01).   Inter-relationship of Services.

Figure 4 (T/SF 31-01).   Procedural aspects of call offering.