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**Integrated Services Digital Network (ISDN);
Circuit-mode multiple-rate unrestricted 8 kHz
structured bearer service category
Service description**

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

In accordance with CCITT Recommendation I.130 [1], the following three level structure is used to describe the supplementary telecommunications services as provided by European public telecommunications operators under the pan-European Integrated Services Digital Network (ISDN):

- Stage 1: is an overall service description, from the user's standpoint;
- Stage 2: identifies the functional capabilities and information flows needed to support the service described in stage 1; and
- Stage 3: defines the signalling system protocols and switching functions needed to implement the service described in stage 1.

This ETS details the stage 1 aspects (overall service description) for the circuit-mode multiple-rate bearer service category. The stage 2 and stage 3 aspects are detailed in a general form in ETS 300 350 (endorsement of ITU-T Recommendation Q.71 (1993)) and ETS 300 403, respectively.

This bearer service category is also known as the $n \times 64$ kbit/s bearer service category.

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1 Scope

This standard defines the stage one of the circuit-mode multiple-rate bearer service category for the pan-European Integrated Services Digital Network (ISDN) as provided by European public telecommunications operators. Stage one is an overall service description from the user's point of view (see CCITT Recommendation I.130 [1]), but does not deal with the details of the human interface itself.

This standard defines the interworking requirements of private ISDNs with the public ISDN.

In addition, this standard specifies the base functionality where the service is provided to the user via a private ISDN.

The standard does not specify the additional requirements where the service is provided to the user via a telecommunications network that is not an ISDN but does include interworking requirements of other networks with the public ISDN.

Charging principles are outside the scope of this standard.

The values of the general attributes are outside the scope of this standard.

The circuit-mode multiple-rate bearer service category provides unrestricted information transfer at integer multiples of 64 kbit/s between reference points. Each of these reference points can be either a S reference point or coincident S and T reference points (see ITU-T Recommendation I.411 [2]).

NOTE: Service providers can also provide information transfer with the same attributes where the reference point is the T reference point.

This standard contains the procedures for the on-demand service variant of this bearer service category. The procedures for the permanent and the reserved service variants are outside the scope of this standard.

This standard is applicable to the stage two and stage three standards for the ISDN circuit-mode multiple-rate bearer service category. The terms "stage two" and "stage three" are also defined in CCITT Recommendation I.130 [1]. Where the text indicates the status of a requirement (i.e. as strict command or prohibition, as authorisation leaving freedom, or as a capability or possibility), this shall be reflected in the text of the relevant stage two and stage three standards.

Furthermore, conformance to this standard is met by conforming to the stage three standards with the field of application appropriate to the equipment being implemented. Therefore, no method of testing is provided for this standard.

2 Normative references

This standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] CCITT Recommendation I.130 (1988): "Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".
- [2] ITU-T Recommendation I.411 (1993): "ISDN user-network interfaces - reference configurations".
- [3] ITU-T Recommendation I.112 (1993): "Vocabulary of terms for ISDNs".
- [4] ITU-T Recommendation I.210 (1993): "Principles of telecommunication services supported by an ISDN and the means to describe them".
- [5] CCITT Recommendation E.164 (1991): "Numbering plan for the ISDN era".
- [6] ITU-T Recommendation I.221 (1993): "Common specific characteristics of services".
- [7] ITU-T Recommendation I.140 (1993): "Attribute technique for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".
- [8] CCITT Recommendation I.220 (1988): "Common dynamic description of basic telecommunication services".
- [9] ETS 300 345: "Integrated Services Digital Network (ISDN); Interworking between public ISDNs and private ISDNs for the provision of telecommunications services General aspects".
- [10] CCITT Recommendation I.231.10: "Circuit-mode multiple-rate unrestricted 8 kHz structured bearer service category".

3 Definitions

For the purpose of this standard, the following definitions apply:

bearer service: See ITU-T Recommendation I.112 [3], § 2.2, definition 202.

basic access: See ITU-T Recommendation I.112 [3], § 2.4, definition 425.

Integrated Services Digital Network (ISDN): See ITU-T Recommendation I.112 [3], § 2.3 definition 308.

ISDN number: A number conforming to the numbering plan and structure specified in CCITT Recommendation E.164 [5].

network operator: Entity which provides the network operating elements and resources for the execution of this bearer service.

primary rate access: See ITU-T Recommendation I.112 [3], § 2.4, definition 426.

retention timer: This timer specifies the amount of time that the network retains all of the information supplied by the calling user when the call encounters busy or is terminated.

service; telecommunications service: See ITU-T Recommendation I.112 [3], § 2.2, definition 201.

service provider: Entity which offers this bearer service subscription. The network operator may be the service provider.

supplementary service: See ITU-T Recommendation I.210 [4], § 2.4.

Time Slot Sequence Integrity (TSSI): TSSI characterizes the ability of the ISDN to maintain the relative position of every time slot within a frame (intra-frame integrity) and between consecutive frames (inter-frame integrity) from one basic access or primary rate access to the other basic access or primary rate access. The TSSI characteristics are described in annex A.

user determined user busy: See ITU-T Recommendation I.221 [6], § 2.1.4.

4 Symbols and abbreviations

ISDN	Integrated Services Digital Network
LAN	Local Area Network
TSSI	Time Slot Sequence Integrity

5 Description

The circuit-mode multiple-rate bearer service category supports unrestricted information transfer rates at integer (N) multiples of B-channels up to the maximum rate of the basic access or primary rate access.

The circuit-mode multiple-rate bearer service category shall apply to the basic access and to the primary rate access.

User information shall be transferred over multiple B-channels. Signalling shall be provided over a D-channel.

For the basic access, the value of N shall be 2.

For the primary rate access, N shall be any value in the range of 2 to 30. As a service provider option, the support of the circuit-mode multiple-rate bearer service category can be restricted to the use of one or more values of N.

NOTE 1: It is recommended that the network, as a minimum, supports N=2, 6, 24 and 30 for the primary rate access.

For a specific call, all the B-channels involved in the call shall be restricted to the same basic access or primary rate access.

Any free B-channel can be assigned to the call.

For the circuit-mode multiple-rate bearer service category, more than one call on an interface can be in progress simultaneously, providing that the combined values of N do not exceed the value of the subscription option for the maximum number of B-channels available for this bearer service category.

NOTE 2: This subscription option may be used in order to reserve capacity for other bearer services or teleservices to be used on the same basic access or primary rate access.

To maintain the order of data submitted by one user when that data is delivered to the other user, the Time Slot Sequence Integrity (TSSI) channel structure shall be supported by this bearer service category.

The circuit-mode multiple-rate bearer service category shall allow communication in both directions between two users (e.g. terminals, private telecommunication network exchanges) in a point-to-point communication configuration via the ISDN using digital signals over multiple 64 kbit/s channels.

The circuit-mode multiple-rate bearer service category can be used to support various applications. Examples include:

- EXAMPLE 1: File and data transfer applications.
- EXAMPLE 2: Transparent access to frame mode (frame relay or frame switching) networks.
- EXAMPLE 3: Interconnection of Local Area Networks (LANs).
- EXAMPLE 4: Audio-visual applications.

6 Procedures

6.1 Provision and withdrawal

The circuit-mode multiple-rate bearer service category shall be provided after prior arrangement with the service provider.

The circuit-mode multiple-rate bearer service category can be provided on an ISDN number basis, or can be provided to the whole interface.

NOTE: It should be noted that in this context an interface may consist of one or more basic accesses and/or primary rate accesses.

As a service provider option, the circuit-mode multiple-rate bearer service category can be offered with one subscription option.

The subscription option for the interface is given in table 1.

Table 1: Subscription options for the interface

Subscription option	Value
Maximum number of B-channels available for the circuit-mode multiple-rate bearer service category	- m, where m is not greater than the number of B-channels on the interface

The circuit-mode multiple-rate bearer service category shall be withdrawn by the service provider upon the request of the subscriber, or for service provider reasons.

Some examples of configurations are given in figure 1.

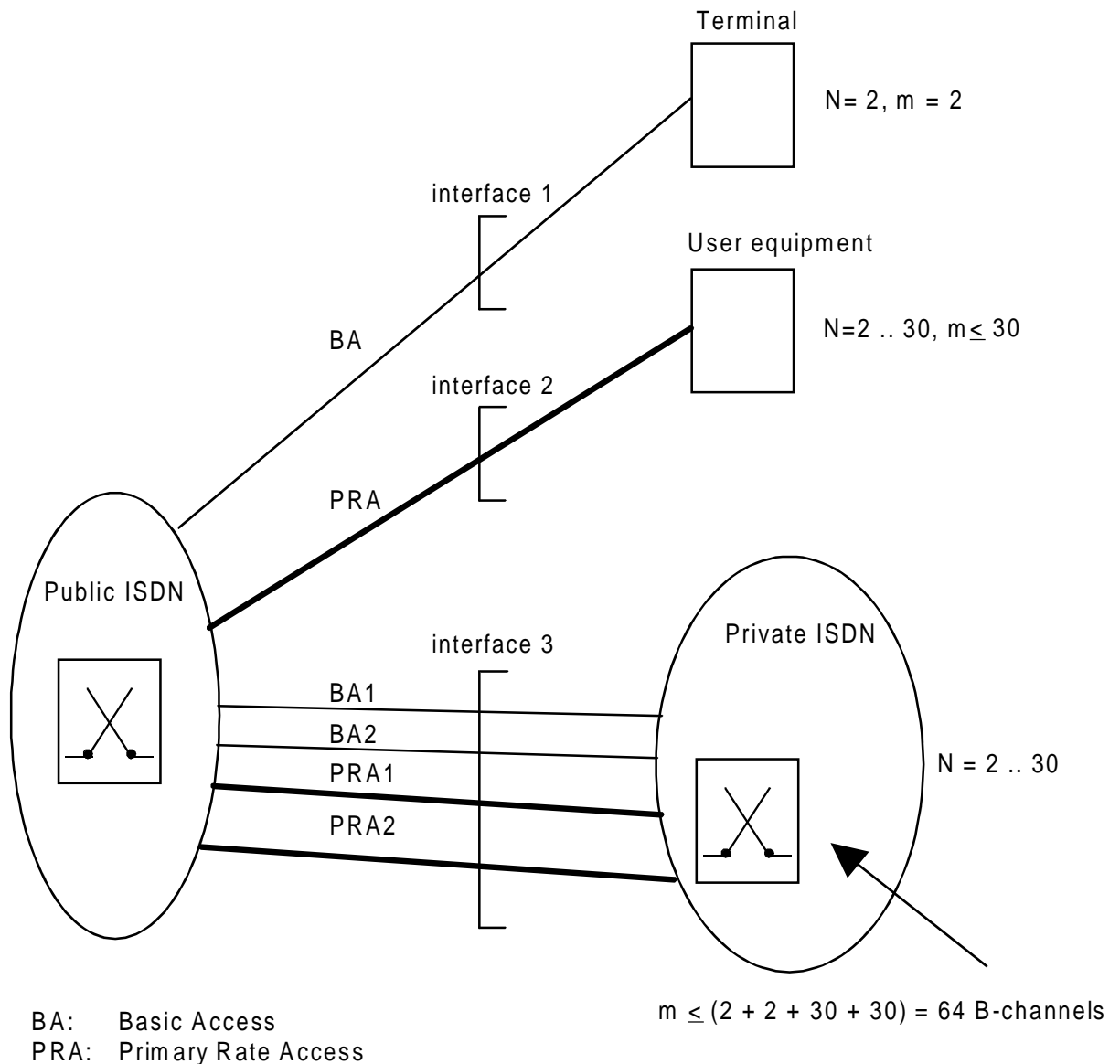


Figure 1: Configuration examples

6.2 Normal procedures

The network shall provide out-of-band indications to indicate call progress.

6.2.1 Originating the call (call establishment)

When originating a call, the served user shall request from the network the required circuit-mode multiple-rate bearer service category. This request shall include an ISDN number identifying the called user and the information transfer rate needed (e.g. 128 kbit/s, 192 kbit/s, etc.) which shall remain the same for the whole duration of the call. Other information, as required, for use by the network in connection with supplementary services provided to the called user (e.g. the calling line identification presentation supplementary service) can also be included.

The identity of the called user can be given to the network either en-bloc, containing all the required information, or not en-bloc.

The B-channels selected shall be restricted to the same basic access or primary rate access.

6.2.2 Indications during call establishment

After initiating a call, the calling user shall receive an acknowledgement that the network can process the call. The called user shall receive an indication of the arrival of the incoming call of the circuit-mode multiple-rate bearer service category. The information transfer rate shall also be indicated.

When an indication that the called user is being informed of the call is received by the network, the calling user shall also be given an indication that the incoming call is being offered to the called user.

When the connection is established, an indication of this shall be sent to the calling user. The called user can also provide other information for use by the network in connection with supplementary services provided to other users (e.g. the connected line identification presentation supplementary service).

Once the connection is established, the multiple B-channels shall then be available for the transmission of digital signals over multiple 64 kbit/s channels in both directions without alteration by the network. No restriction is placed by the network on the content of the digital signals.

6.2.3 Terminating the call

The call can be terminated by either of the users indicating this to the network. If one user terminates the call, and the other user has not terminated the call, the other user shall be sent an appropriate indication by the network.

6.3 Exceptional procedures

6.3.1 Situations at the calling user side

When the network receives an improper service request from a user, an appropriate indication shall be sent to that user by the network and the call establishment shall be ceased.

A user inputting an invalid ISDN number shall be given the appropriate failure indication by the network and the call establishment shall be ceased.

Users can input network address information subsequent to the service request (i.e. overlap sending). In this case, if the user fails to enter address information or subsequent parts the address within network determined time intervals, that user shall be sent the appropriate indication by the network and the call establishment shall be ceased.

If the network cannot comply with the request for the information transfer rate e.g. due to insufficient available B-channels on any basic access or primary rate access on the calling user's interface, or when the requested value of N is not supported by the service provider, the user shall be given the appropriate indication by the network and the call establishment shall be ceased.

NOTE: During an interim period some network signalling systems can only support the "N" values 2, 6, 24 and 30 and a request for a connection with an "N" value different from these will be rejected.

6.3.2 Situations at the called user side

On a call to a user whose basic access or primary rate access cannot support the specified information transfer rate (i.e. it exceeds the subscription for the maximum number of B-channels available at the called user), the calling user attempting to establish the call shall be given an appropriate indication by the network and the call establishment shall be ceased.

If the network cannot comply with the request for the information transfer rate e.g. due to insufficient available B-channels on any basic access or primary rate access on the called user's interface, the calling user shall be given the appropriate indication by the network and the call establishment shall be ceased.

A calling user attempting to establish a call to a user who is identified by the network to be user determined user busy shall be given the appropriate indication by the network and the call establishment shall be ceased.

A user attempting to establish a call to a user whose terminal equipment fails to respond shall be given an appropriate indication by the network and the call establishment shall be ceased.

On a call to a user whose terminal equipment has responded that the called user is being informed of the call, but has failed to establish a connection within a defined period of time, the calling user attempting to establish the call shall be given an appropriate indication by the network and the call establishment shall be ceased.

6.3.3 Situations due to network conditions

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) shall be given the appropriate indication by the network.

If the network detects a failure after the connection has been established (e.g. a transmission fault), the call shall be terminated by the network.

NOTE: However, since the network has no end-to-end mechanisms to monitor, e.g. TSSI or the requested information transfer rate during an active call, failures may occur that cannot be detected by the network. In these cases it is the responsibility of the user equipment to detect the fault and to take appropriate actions, e.g. release the connection.

6.3.4 Retention of call information

If a user attempts to establish a call but meets problems due to network conditions (e.g. congestion) or called user state (e.g. user determined user busy) then, according to a network option, the network shall retain all of the information supplied by the calling user for the duration of the retention timer. The value of this timer shall be greater than 15 seconds.

7 Intercommunication considerations

7.1 Interworking between public ISDNs

If a call from a user in one public ISDN to a user in another public ISDN requires a value of "N" (see clause 5) which cannot be supported by both public ISDN, then this shall be indicated to the calling user and the call establishment shall be ceased.

7.2 Interworking with non-ISDNs

When interworking between an ISDN and a non-ISDN is not possible, then this shall be indicated to the calling user and the call establishment shall be ceased.

7.3 Interworking with private ISDNs

The situation where the communicating users are attached to a private ISDN and a public ISDN is addressed in clauses 5 and 6. General information is given in ETS 300 345 [9].

If a call between a public ISDN and a private ISDN requires a value of "N" (see clause 5) which cannot be supported by the ISDN, then this shall be indicated to the calling user and the call establishment shall be ceased.

8 Applicability of supplementary services

NOTE: The applicability of some supplementary services is described in annex B.

If the in-band communication is interrupted by the network as a result of one user invoking a supplementary service (e.g. the call hold supplementary service, or the terminal portability supplementary service) then the network shall provide an appropriate indication (e.g. all ones or the idle signal) in the B-channel.

9 Static description of the service using attributes

The attributes are defined in ITU-T Recommendation I.140 [7], annex A, § A.1.1.

The values of the attributes are defined in ITU-T Recommendation I.140 [7], annex A, § A.2.

9.1 Low layer attributes

9.1.1 Information transfer attributes

The information transfer attributes of the circuit-mode multiple-rate bearer service category are specified in table 2.

Table 2: Values of information transfer attributes

Attribute	Possible values
Information transfer mode	circuit
Information transfer rate	128, 192, ..., 1 920 kbit/s
Information transfer capability	unrestricted digital information
Structure	8 kHz, TSSI
Establishment of communication	- demand - reserved - permanent
Symmetry	bidirectional symmetric
Communication configuration	point-to-point

9.1.2 Access attributes

The access attributes of the circuit-mode multiple-rate bearer service category are specified in table 3.

Table 3: Values of access attributes

Attribute	Possible values
Access channel and rate	User information: - multiple B-channels Signalling: - D-channel (16 kbit/s or 64 kbit/s)
Signalling access protocol, information access protocol	User information: - not applicable Signalling: - ETS 300 125, ETS 300 403

9.2 High layer attributes

Not applicable.

9.3 General attributes

This standard does not provide values for general attributes.

10 Dynamic description

The dynamic description of this service on a demand basis is given in CCITT Recommendation I.220 [8], as modified by CCITT Recommendation I.231.10 [10], § 9.

Annex A (informative): Time slot sequence integrity

TSSI characterizes the ability of the ISDN to maintain the relative position of every time slot within a frame (intra-frame integrity) and between consecutive frames (inter-frame integrity) from one basic access or primary rate access to the other basic access or primary rate access.

Although TSSI is applicable to both the primary rate access and the basic access, the information in this annex relates only to the primary rate access.

A.1 Frame format

Across coincident S and T reference points of a 2 048 kbit/s user-network interface, the bit stream is carried in frames having the format shown in figure A.1. The frame is structured as 30 eight-bit time slots with two additional time slots for framing and signalling. The frame repeats itself every 125 μ s (8 000 times per second). The time slots occupying the same position in 8 000 successive frames form a B-channel.

A channel, as defined in CCITT Recommendation I.412, represents a specified portion of the information-carrying capacity of an interface. For an information transfer rate of 64 kbit/s, one time slot per frame is used.

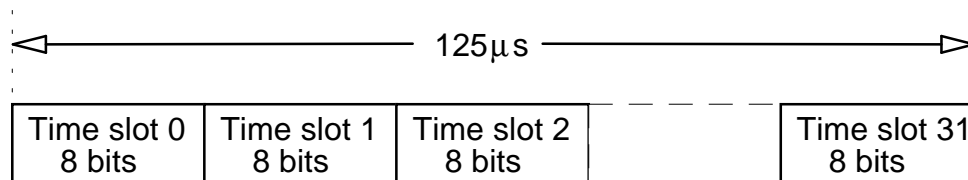


Figure A.1: Frame format of the 2 048 kbit/s interface

In order to achieve information transfer rate higher than 64 kbit/s allowed by the circuit-mode multiple-rate bearer service category, several time slots (not necessarily contiguous) per frame are required. For example, to support an information transfer rate of 192 kbit/s, 3 time slots per frame are required.

A.2 Inter-frame integrity

Between frames, TSSI is maintained by treating the time slots of a channel carried in a frame as a unit. This is illustrated in figure A.2.

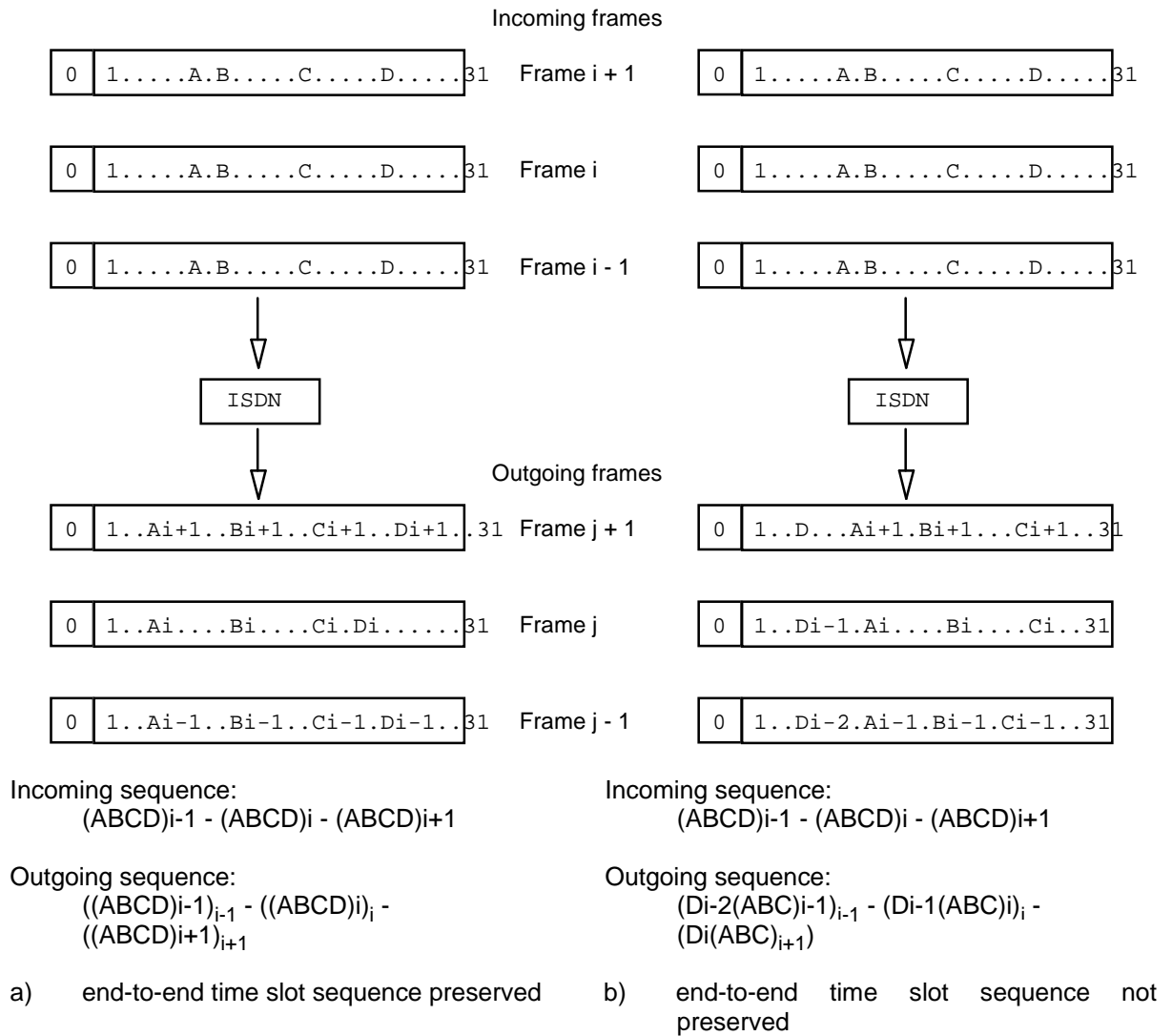


Figure A.2: Inter-frame TSSI

A.3 Intra-frame integrity

Within a frame, TSSI ensures that the time slots allocated to a channel will maintain their same relative positions in the incoming and outgoing frames. This is illustrated in figure A.3.

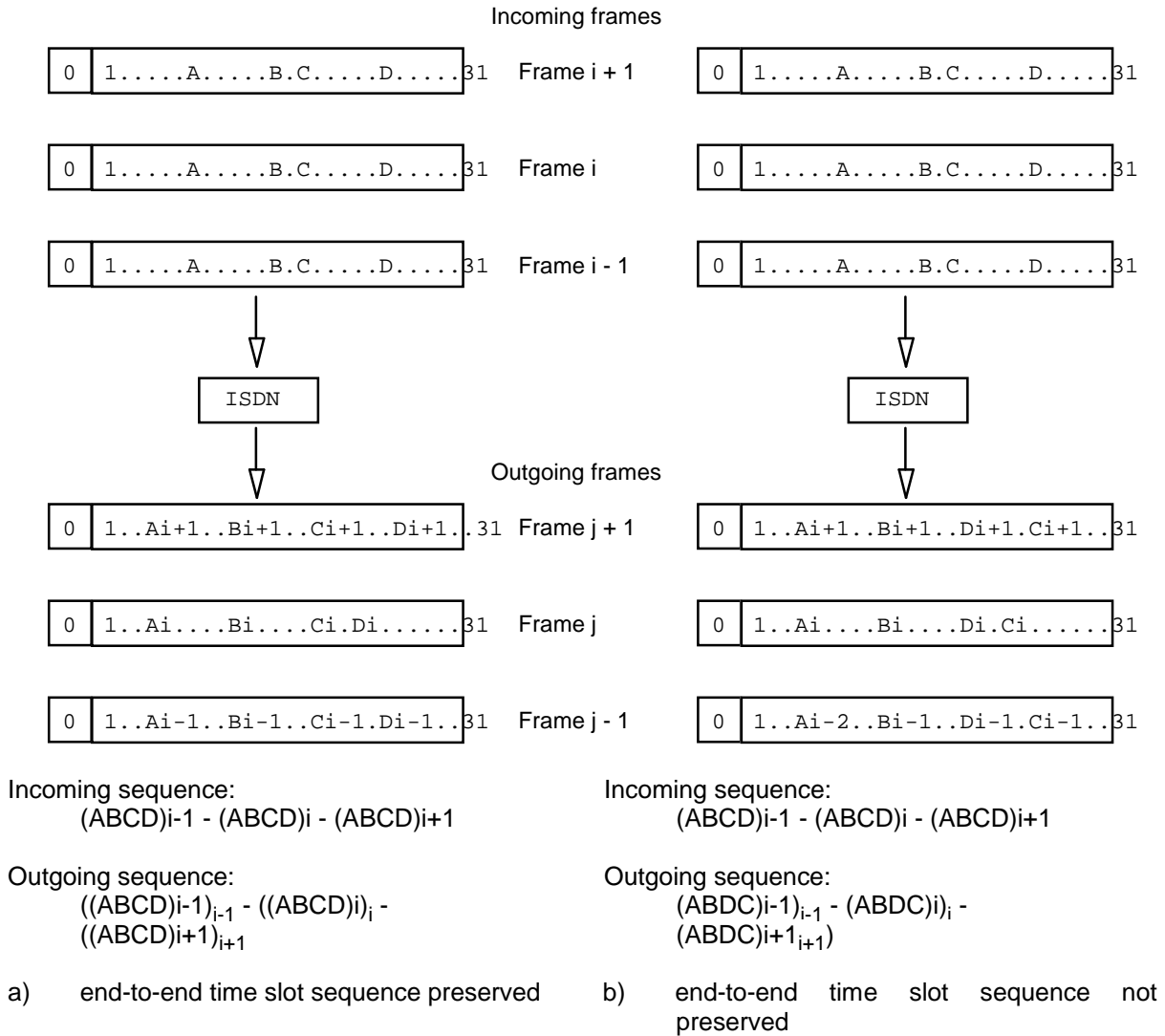


Figure A.3: Intra-frame TSSI

Annex B (informative): Applicability of supplementary services to the circuit-mode multiple-rate bearer service category

There are no additional service requirements in the application of the following ETSI standardized supplementary services:

- a) the advice of charge services:
 - 1) the advice of charge: charging information at call set-up time supplementary service;
 - 2) the advice of charge: charging information during the call supplementary service;
 - 3) the advice of charge: charging information at the end of a call supplementary service;
- b) the number identification services:
 - 1) the calling line identification presentation supplementary service;
 - 2) the calling line identification restriction supplementary service;
 - 3) the connected line identification presentation supplementary service;
 - 4) the connected line identification restriction supplementary service;
- c) the closed user group supplementary service;
- d) the direct dialling in supplementary service;
- e) the call diversion services:
 - 1) the call forwarding busy supplementary service;
 - 2) the call forwarding unconditional supplementary service;
 - 3) the call forwarding on no reply supplementary service;
 - 4) the call deflection supplementary service;
- f) the malicious call identification supplementary service;
- g) the subaddressing supplementary service;
- h) the user-to-user signalling supplementary service;
- i) the multiple subscriber number supplementary service.

Supplementary services which are not listed above may require modification to enable them to operate on calls using the circuit-mode multiple-rate bearer service category.

Annex C (informative): Bibliography

The following references are used for informative purposes in this ETS.

- 1) ETS 300 125: "Integrated Services Digital Network (ISDN); User-network interface data link layer specification; Application of CCITT Recommendations Q.920/I.440 and Q.921/I.441".
- 2) ETS 300 350: "Integrated Services Digital Network (ISDN); Basic call handling for circuit switched telecommunication services".
- 3) ETS 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface layer 3; Part 1: Specifications for basic call control".
- 4) ETS 300 403-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface layer 3; Part 2: Specifications for basic call control; Specification Description Language (SDL) diagrams".
- 5) ETS 300 403-3: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface layer 3; Part 3: Specifications for basic call control; Protocol Implementation Conformance Statement (PICS) proforma".
- 6) CCITT Recommendation I.412 (1988): "ISDN user-network interfaces - Interface structures and access capabilities".

History

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