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for the provision of telecommunication services;
General aspects**

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE

Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE

X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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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).

This ETS details the general aspects of interworking between public Integrated Services Digital Networks (ISDNs) and private ISDNs for the provision of telecommunication services.

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Introduction

Work on this standard began as a result of an agreement between rapporteurs from ETSI Sub Technical Committee (STC) NA 1 and rapporteurs from Technical Committee TC 32-TG6 of the European Computer Manufacturers' Association (ECMA). That agreement recognised the need for a single text which documents items that were common to supplementary services in order to avoid repetition in each of the service descriptions.

Subsequently the text has been refined by NA 1 in consultation with Signalling, Protocols and Switching (SPS) Technical Committee of ETSI.

This standard includes normative information on the interworking between public ISDNs and private ISDNs. It indicates reference points where this has to occur.

The standard has been developed as a reference document for the standardisation of telecommunication services when these services are provided in either or both ISDNs and thus service interworking becomes necessary for calls involving both public ISDNs and private ISDNs.

In developing this standard it has been assumed that as a general rule, the same terminals can be connected to the public ISDN or to the private ISDN.

This standard does not cover virtual private network configurations.

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1 Scope

This standard describes general requirements on standards for services with respect to interworking between public Integrated Services Digital Networks (ISDNs) and private ISDNs. This standard describes the different mechanisms whereby services implemented by public ISDNs can be provided to users attached to private ISDNs.

Service specific information on the interworking between public ISDNs and private ISDNs is given in the various standards for the individual bearer services, teleservices and supplementary services.

In addition, this standard identifies the need for general procedures in the public ISDN required to support the transport of information given to other users as a result of the operation of services in the private ISDN.

Consideration of regulatory requirements placed on public ISDNs and/or private ISDNs is outside the scope of this standard.

For the purpose of this standard, only the accesses used for interworking between public ISDNs and private ISDNs are considered. The use of accesses for any other purpose e.g. for private networking over leased-lines via semi-permanent connections, is outside the scope of this standard.

Charging principles are outside the scope of this standard.

This standard is applicable to the stage one standards describing individual services for public ISDNs and to standards describing general public ISDN procedures for ISDN services. This standard is also applicable to the stage two and stage three standards for the individual services for public ISDNs described in the stage one standards. The terms "stage one", "stage two" and "stage three" are defined in CCITT Recommendation I.130 [1].

Standards, or parts of standards, describing requirements on private ISDNs are outside the scope of this standard.

Furthermore, conformance to this standard is met by equipment conforming to the stage three standards (which in turn conform to this standard and the relevant stage 1 and stage 2 standards) with the field of application appropriate to the equipment being implemented. Conformance to this standard by the stage 1, stage 2 and stage 3 standards can be checked by inspection. 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] CCITT Recommendation I.411 (1988): "ISDN user-network interfaces - Interface structures and access capabilities".
- [3] CCITT Recommendation E.164 (1991): "Numbering plan for the ISDN era".
- [4] CCITT Recommendation I.112 (1988): "Vocabulary of terms for ISDNs".
- [5] CCITT Recommendation I.210 (1988): "Principles of telecommunications services supported by an ISDN and the means to describe them".
- [6] CCITT Recommendation Q.65 (1988): "Stage 2 of the method for the characterization of services supported by an ISDN".

3 Definitions

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

public ISDN: An ISDN which provides services to the general public.

private ISDN: An ISDN which provides services to a specific set of users only.

S reference point: The reference point at which terminals are indirectly connected with the public ISDN, i.e. are attached to a private ISDN and communicate with the public ISDN via a private ISDN. In figures, this reference point is denoted by **S**. See CCITT Recommendation I.411 [2].

T reference point: The reference point at which a private and a public ISDN are interconnected and have to interwork for the provision of telecommunication services. In figures, this reference point is denoted by **T**.

For the purpose of this standard the term "T reference point" shall always denote the service interworking point between a public ISDN and a private ISDN, i.e. other interworking situations between the public ISDN and other equipment, as conceivable according to CCITT Recommendation I.411 [2], are excluded.

coincident S and T reference points: These reference points coincide when terminals are directly attached to the public ISDN. In figures, this is denoted by **S/T**.

NOTE: The notation S/T should not be interpreted as "either S or T".

service provider function: Within a public ISDN or private ISDN, the functionality which provides a bearer service, or a teleservice, excluding any possible terminal functionality for that service.

terminal equipment: See CCITT Recommendation I.411 [2], § 3.4.3.

service, telecommunication service: See CCITT Recommendation I.112 [4], § 2.2, definition 201.

bearer service: See CCITT Recommendation I.112 [4], § 2.2, definition 202.

teleservice: See CCITT Recommendation I.112 [4], § 2.2, definition 203.

supplementary service: See CCITT Recommendation I.210 [5], § 2.4.

Integrated Services Digital Network (ISDN): See CCITT Recommendation I.112 [4], § 2.3, definition 308.

served user: The user to whom a bearer service, teleservice or supplementary service is provided.

functional entity: See CCITT Recommendation Q.65 [6], § 2.1.1.

ISDN number: A number conforming to the numbering plan and structure specified in CCITT Recommendation E.164 [3].

4 Symbols and abbreviations

For the purposes of this standard, the following abbreviations apply:

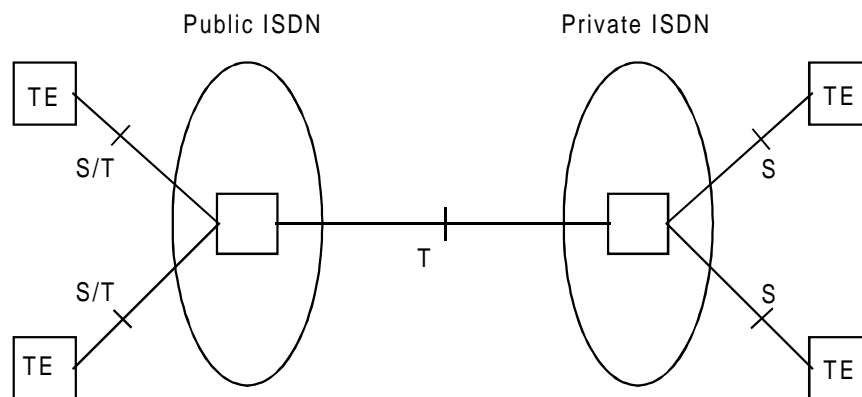
| | |
|------|-------------------------------------|
| FE | Functional Entity |
| ISDN | Integrated Services Digital Network |
| SPF | Service Provider Function |
| TE | Terminal Equipment |

5 Specification boundaries

Standards for specific public ISDN services shall be specified in relation to users whose equipment is connected to the public ISDN by an interface at the coincident S and T reference points. The interworking aspects of these services with private ISDNs shall be specified in relation to T reference points.

Standards for general procedures in public ISDNs specifying interworking aspects with private ISDN services shall be specified in relation to T reference points and, where appropriate, to coincident S and T reference points. The standards for these general procedures shall define how the information is relayed to the user in the other ISDN.

An overview of specification boundaries is given in figure 1.



NOTE: For simplicity reasons, this figure shows only the connection of one private ISDN with one public ISDN. Other configurations can also occur e.g. the configuration where one private ISDN is connected to another private ISDN via a public ISDN.

Figure 1: Specification boundaries

6 Service provision

This standard does not require that corresponding services in both types of ISDN are absolutely identical. However, interworking will be more complicated when there are significant differences. In order to ease problems in interworking between services in the public ISDN and in the private ISDN, where no standard for a particular service exists in the public ISDN, but a corresponding standard exists for the service in the private ISDN, the private ISDN standard shall be used as the basis (and vice versa). More information can be found in annex D of ETR 076.

In order to use a service, the served user has access to a Service Provider Function (SPF). For the purposes of this standard, teleservices are viewed as being supported by one SPF for each of the private ISDNs and one SPF for each of the public ISDNs involved. A standard for a teleservice in a public ISDN shall describe bearer services and bearer capabilities required for the support of that teleservice when interworking with private ISDNs.

Supplementary services can be supported by several cooperating SPFs in an ISDN. For the purposes of this standard, supplementary services are viewed as being supported by one SPF for each of the private ISDNs and one SPF for each of the public ISDNs involved. A standard for a supplementary service in a public ISDN shall describe the requirements for the support of that supplementary service when interworking with private ISDNs.

Where calls pass through a public ISDN and a private ISDN, the SPFs of both ISDNs will be involved (see figure 2). For supplementary service functionality, however, one of the SPFs may be transparent.

The degree of involvement of each SPF varies, depending on the bearer service, teleservice or supplementary service concerned. For bearer services and teleservices, there will be similar functionality in both ISDNs. For supplementary services, there can be different involvement and different functionality in each network.

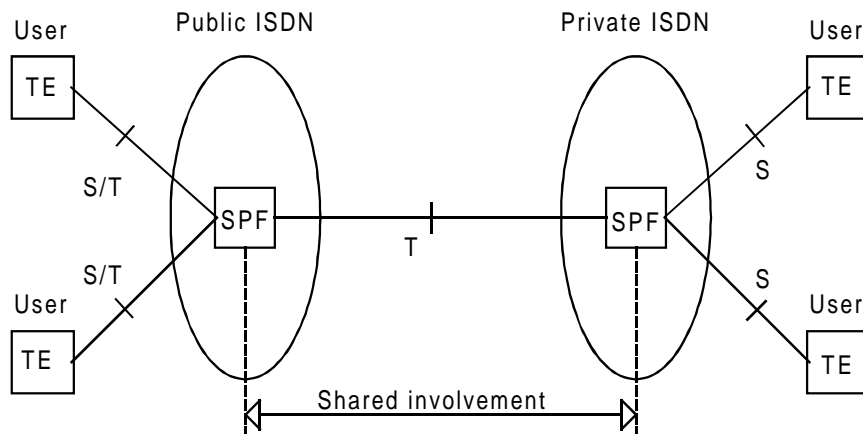


Figure 2: Example of the involvement of SPFs in providing a telecommunication service when interworking occurs between a public ISDN and a private ISDN

In public ISDNs and private ISDNs, the involvement of SPFs in a specific supplementary service needs to be defined.

Supplementary services can be placed into one or more of the following provision categories, depending on the involvement of the SPFs:

- **local provision:** if the SPF in only one ISDN is involved. This can be with or without notification to users in the other ISDN. With local provision, the ISDN containing the SPF can be used by the other ISDN, in the same way that a user attached at the coincident S and T reference points or the S reference point can use a supplementary service. Also the SPF can send notifications to the other ISDN;
- **double provision:** local provision in one ISDN associated with local provision in the other ISDN. For example the invocation of the public ISDN service by the private ISDN at the T reference point can enable the private ISDN to offer the service to the user at the S reference point;
- **cooperative provision:** the supplementary service requires an SPF in the public ISDN and an SPF in the private ISDN. This case requires intercommunication between these SPFs, whose functions complement each other.

Some supplementary services can be classified as local provision under some circumstances but cooperative provision under other circumstances e.g. depending on which particular aspects of the supplementary service are employed or the routing of a particular call that uses the supplementary service. Standards for supplementary services shall include procedures for both local provision and cooperative provision. It shall be a service provider option to decide under which conditions the different procedures are used.

As a consequence of the cooperation needed between SPFs in the public ISDN and the private ISDN to handle the provision of common services in calls involving both public ISDNs and private ISDNs, the information exchanged at the T reference point between two ISDNs can be different from that to be exchanged between terminals and the ISDN at the S reference point and coincident S and T reference points. Therefore, the services of the public ISDN shall, where appropriate, take account of these two types of customer configurations.

6.1 Relationship to stage 1 standards for public ISDNs

"Local" provision of a service by a public ISDN shall be described within the "procedures" clause of the standard for that service. Applicability of the service to private ISDNs and/or users in the private ISDN shall be indicated in the scope clause and other clauses in the standard.

Standards for public ISDNs shall consider "double" provision of a service as two instances of local provision, one by the public ISDN and one by the private ISDN. Only the local provision of the service by the public ISDN shall be described by the stage 1 standard for the public ISDN, in the "procedures" clause. Examples of "double" provision are the advice of charge supplementary services.

"Cooperative" provision of a service shall be described by a combination of the procedures clause and other clauses in the standard which contain additional requirements for interworking between public and private ISDNs. As an example, the completion of calls to busy subscribers supplementary service is implemented in a "cooperative" manner.

6.2 Relationship to stage 2 standards for public ISDNs

At stage 2, "local" provision, "double" provision, and "cooperative" provision may each be covered by one or more scenarios.

NOTE: For simplicity, figures 3, 4, 5 and 6 show only a single Functional Entity (FE) at each location. These FEs represent the supplementary service functionality of the involved SPFs. Some supplementary services may result in several FEs at each location.

6.2.1 Local provision

"Local" provision of a service by a public ISDN shall result in stage 2 scenarios with FEs located in either:

- 1) the public ISDN and the private ISDN (figure 3); or
- 2) the public ISDN and the terminal (figure 4); or
- 3) the private ISDN and the terminal (figure 5).

For a scenario identified in figure 3, a stage 2 standard for a supplementary service in the public ISDN shall cover the interworking case of local provision by a public ISDN by the inclusion of one or more scenarios in which all FEs that form the SPF are located in the public ISDN, but FEs associated with a service user are located in a private ISDN.

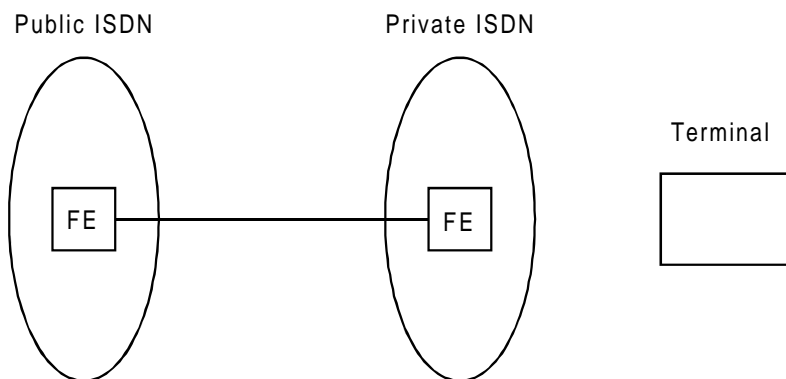


Figure 3: "Local" provision - public ISDN provides a service locally to a private ISDN

For the scenario identified by figure 4, a stage 2 standard for a supplementary service in the public ISDN shall cover the interworking case for the provision of notifications where the receiver of notifications is located in the private ISDN.

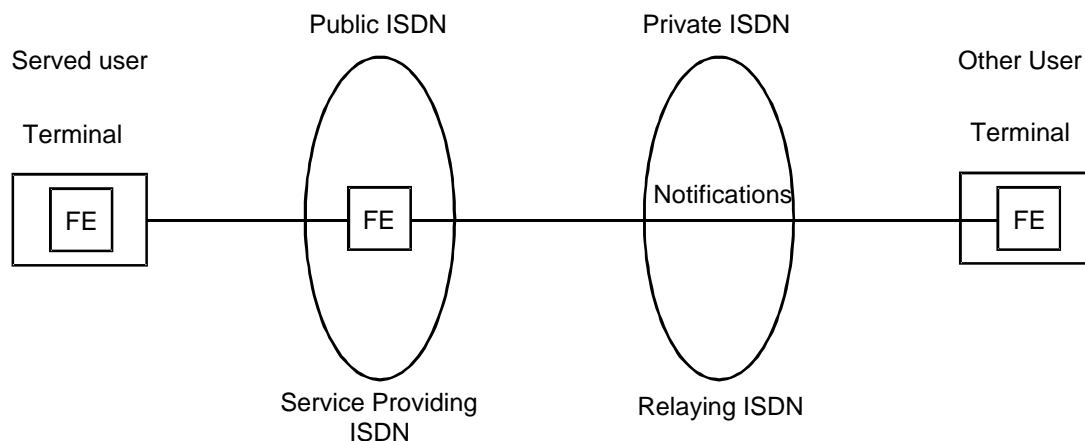


Figure 4: "Local" provision - public ISDN is service provider to a user of the public ISDN - private ISDN relays the notification to a non-served user

For the scenario identified by figure 5, a stage 2 standard for a supplementary service in the public ISDN shall also cover the interworking case of local provision by a private ISDN by inclusion of one or more scenarios in which all FEs that form the SPF are located in the private ISDN but FEs for receipt of notifications are located in a public ISDN or in a TE attached to a public ISDN at the coincident S and T reference points.

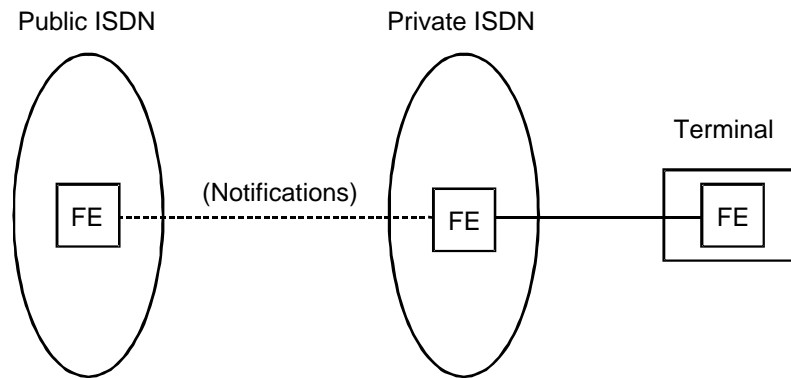
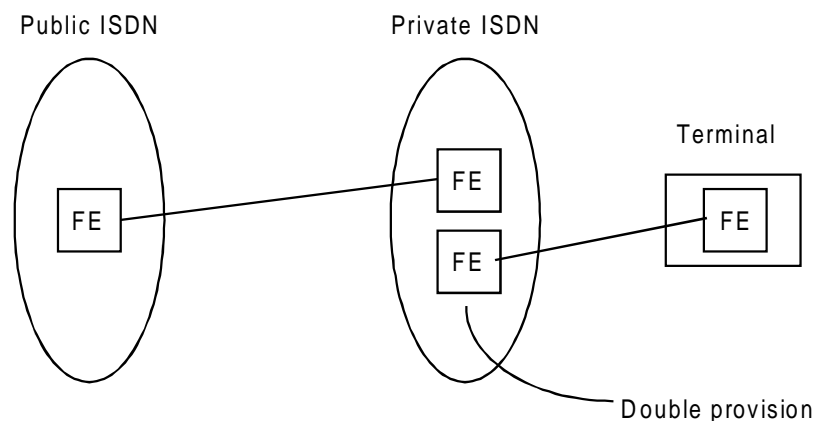


Figure 5: "Local" provision in private ISDN with or without notification

NOTE: In each case there is no need to define the precise location of an FE in the private ISDN e.g. whether it is located in a private ISDN or a TE attached to the private ISDN at the S reference point.

6.2.2 Double provision

In the case of "double" provision, one set of functional entities shall be located in the public ISDN and the private ISDN, and a second set of functional entities will be located in the private ISDN and the attached terminals. The first set of functional entities shall be described by stage 2 standards for public ISDNs. The second set of functional entities is relevant to the stage 2 standards for private ISDNs and are outside the scope of the standards for the public ISDNs (see figure 6).



NOTE: The functional entities in the private ISDN are separate, but may be active at the same time.

Figure 6: "Double" provision

6.2.3 Cooperative provision

"Cooperative" provision (see figure 7) shall result in a stage 2 scenario with functional entities located in:

- 1) the public ISDN; and
- 2) the private ISDN; and
- 3) the terminal.

Stage 2 standards for services classified as "cooperative" shall specify the requirements for public ISDNs in both of the cases where the served user is attached to the public ISDN and where the served user is attached to the private ISDN. In both cases there shall be alignment between the stage 2 standards for the service in the public ISDN and the stage 2 standards of the service in the private ISDN.

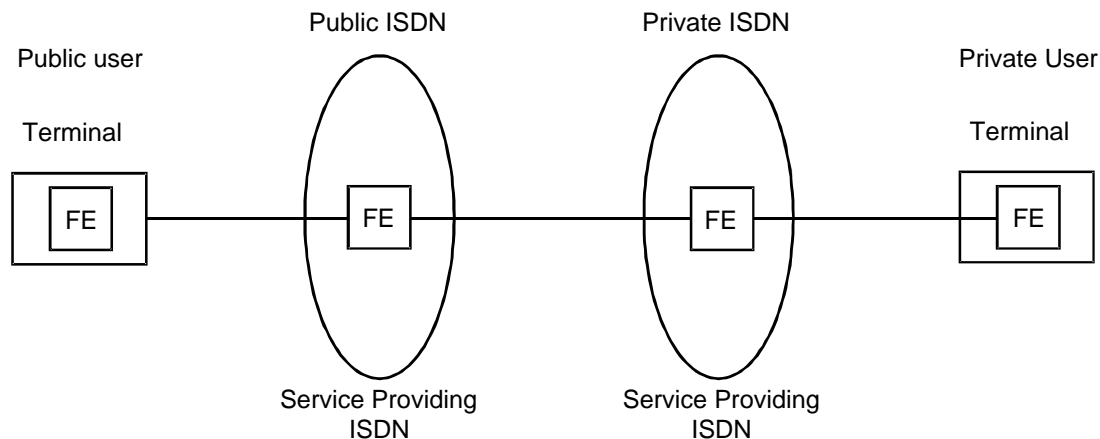


Figure 7: "Cooperative" provision

A stage 2 standard for a supplementary service in the public ISDN shall cover the interworking case of cooperative provision, if applicable to the supplementary service concerned, by the inclusion of one or more scenarios in which some of the FEs that form a public ISDN SPF are located in the public ISDN and FEs that form a private ISDN SPF are located in the private ISDN, with one or more relationships between these FEs passing across the T reference point.

6.3 Relationship to stage 3 standards for public ISDNs

6.3.1 "Local" provision

For local provision when the SPF is provided by a public ISDN, a stage 3 standard for a supplementary service in the public ISDN shall specify that the procedures specified for the coincident S and T reference points shall be applicable also to the T reference point for interworking with a private ISDN. For example: the operation of advice of charge supplementary service provides information to the private ISDN; and the activation of the call forwarding unconditional supplementary service which results in the public ISDN forwarding all calls.

6.3.2 "Double" provision

For double provision two instances of local provision exist:

- 1) local provision where the SPF is provided by a public ISDN;
- 2) local provision where the SPF is provided by the private ISDN.

For 1), the requirements of subclause 6.3.1 apply, for 2), the requirements are described in the standards for the private ISDN. For example the advice of charge supplementary services of the public ISDN can be used to support the advice of charge supplementary services of the private ISDN.

6.3.3 "Cooperative" provision

For "cooperative" provision when one SPF is provided by the public ISDN and another SPF is provided by the private ISDN, a stage 3 standard for a supplementary service in the public ISDN shall specify the procedures applicable at the T reference point for interworking between a public ISDN and a private ISDN. For example: the completion of calls to busy subscriber supplementary service operates in a cooperative manner.

6.4 Relationship to standards for general procedures in public ISDNs

For local provision of a service in the private ISDN requiring interworking with the public ISDN e.g. the relaying of notifications, general procedures shall be documented in standards for public ISDNs in relation to the T reference point.

7 Public/private ISDN configurations

Conceptually, it can be considered that a single connection exists at the T reference point between a public ISDN and a private ISDN. However, in practice there can be more than one instance of a T reference point (see figure 8). Standards for the public ISDN shall support the following configurations:

- one private ISDN connected to more than one public ISDN (e.g. T1 and T4);
- one private ISDN connected to more than one public ISDN exchange in the same public ISDN (e.g. T2 and T3.1);
- one private ISDN exchange connected to more than one public ISDN (e.g. T3.1 and T4);
- one private ISDN exchange connected to more than one public ISDN exchange of the same public ISDN (e.g. T1 and T2);
- one public ISDN connected to more than one private ISDN exchange of the same private ISDN (e.g. T1 and T3.1);
- one public ISDN exchange connected to more than one private ISDN exchange in the same private ISDN (e.g. T1 and T3.2).

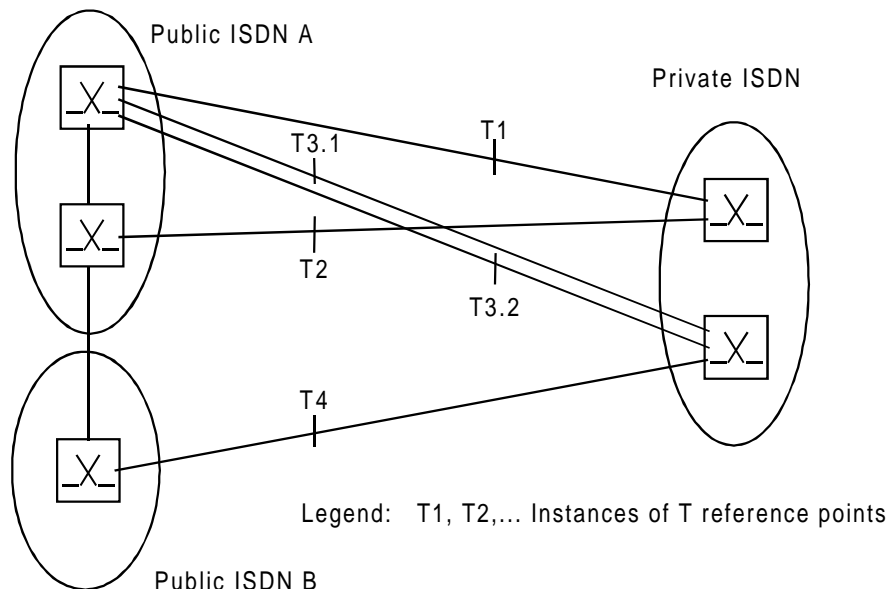


Figure 8: Example of a public/private ISDN configuration

The interconnection between public ISDNs and private ISDNs can consist of any combination of several basic accesses and/or primary rate accesses (e.g. T3.1 and T3.2) (see CCITT Recommendation I.210 [5]). These accesses can be selected either by means of a single number shared by the accesses, or a range of numbers shared by the accesses which may involve the direct dialling in supplementary service.

NOTE: It is recognised that where a private ISDN is connected to more than one public ISDN, services may operate differently depending on, for example, the different network provider options chosen by the public ISDNs.

8 General requirements for interworking between public ISDNs and private ISDNs

Specific requirements for public ISDNs for the interworking between public ISDNs and private ISDNs for individual bearer services, teleservices and supplementary services shall be described in the public ISDN standards for those services and also in the public ISDN standards for general functional procedures. In addition, those standards shall take into account the general interworking requirements described here.

8.1 Numbering

At the T reference point, only ISDN numbers (or parts of them) shall appear, except in the case of the operation of some supplementary services. This shall apply to numbers which are used for selection purposes as well as for identification purposes (e.g. in the context of the calling line identification presentation supplementary service and the connected line identification presentation supplementary service).

NOTE 1: The public ISDN employs the ISDN numbering plan structured according to CCITT Recommendation E.164 [3]. In accordance with ETS 300 189, the private ISDN will employ either the ISDN numbering plan, or a private numbering plan, or both numbering plans.

NOTE 2: Where other numbering schemes are permitted e.g. in the support for private numbering plans supplementary service, this will be indicated in the relevant standards.

NOTE 3: Dialling information is usually composed of the digits of a particular ISDN number. However, according to CCITT Recommendation E.164 [3], besides the ISDN number, dialling information may also consist of further locally defined digits (e.g. prefixes or escape codes). Therefore, numbering plans should not be confused with dialling plans.

8.2 Accesses between public ISDNs and private ISDNs

The standards for public ISDN services shall describe service interworking in a general form to enable service interworking to occur on any type of access (basic access, primary rate access, etc.) between the private ISDN and the public ISDN.

8.3 Access congestion

A public ISDN standard for a service in which congestion can be encountered at an access from a public ISDN to a private ISDN shall specify that the call request be rejected in such circumstances and that the public ISDN provide an indication of congestion to the requesting user.

NOTE 1: The congestion indication may be used, for example, to prevent the invocation of some supplementary services that could be invoked if an indication of busy were to be given instead.

NOTE 2: In some networks, access congestion may result in the calling user being given an indication that the user is busy.

NOTE 3: Some networks may treat some called user installations e.g. small private automatic branch exchanges, as terminals. In such cases, access congestion is considered as busy.

8.4 Protocol requirements

Interworking between private and public ISDNs for the provision of ETSI standardised services shall be based on ETSI standardised functional protocols only.

NOTE: For services not standardised by ETSI, the general functional protocol can still be used in a national application or network specific application. The protocol provides mechanisms to clearly indicate the organisation that defined the protocol. Essentially each proprietary solution will be a functional protocol using elements and procedures from the ETSI defined functional protocols.

8.5 Management

Management aspects are outside the scope of this standard.

NOTE: Requirements for the management of the interface between public ISDNs and private ISDNs and the management of services are contained in CCITT Recommendation M.3010, supplemented by ETR 037 and also in ECMA TR/54.

Annex A (informative): Bibliography

The following references are used informatively within this standard.

- 1) CCITT Recommendation M.3010 (1992): "Principles for a Telecommunications Management Network".
- 2) ETS 300 189 (1992): "Private Telecommunication Network (PTN); addressing".
- 3) ETR 037: "Network Aspects (NA); Telecommunications Management Network (TMN) Objectives, principles, concepts and reference configurations".
- 4) ETR 076: "Integrated Services Digital Network (ISDN); Standards guide".
- 5) ECMA TR/54 (December 1990): "A Management Framework for Private Telecommunication Networks".

History

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