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Foreword

This Technical Committee Reference Technical Report (TCR-TR) has been produced by the Business TeleCommunications (BTC) Technical Committee of the European Telecommunications Standards Institute (ETSI).

A TCR-TR is a deliverable for use inside ETSI which records output results of ETSI Technical Committee (TC) or SubTechnical Committee (STC) studies which are not appropriate for European Telecommunication Standard (ETS), Interim European Telecommunication Standard (I-ETS) or ETSI Technical Report (ETR) status. They can be used for guidelines, status reports, coordination documents, etc. They are to be used to manage studies inside ETSI and shall be mandatorially applied amongst the concerned TCs. They shall also be utilized by the TC with overall responsibility for a study area for coordination documents (e.g. models, reference diagrams, principles, structures of standards, framework and guideline documents) which constitute the agreed basis for several, if not all, TCs and STCs to pursue detailed standards.

Introduction

The work on this integrated scenario TCR-TR was started in March 1991 with the objective of discovering how private and public telecommunication entities could co-operate in the provision of services to Private Telephone Network (PTN) users.

Since this work started, both SRC4 and SRC5 have made recommendations relating to the services that public networks may offer to their corporate customers. Two Virtual Private Network (VPN) workshops were held in December 1992 and March 1993 to consider the SRC4 Recommendations. Later a VPN task group was established to pick up all of this work to propose work items appropriate to the standardization of VPNs. The VPN task group produced its final draft report in April 1994.

Although the terms of reference of both tasks are distinct, it was clear that there was a commonalty of interest and experts. In particular, this integrated scenario report describes an "InterConnecting Network" or "ICN" which may be a component of a VPN.

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1 Scope

This Technical Committee Reference Technical Report (TCR-TR) is intended to provide a common understanding of the concept of the "integrated scenario" for business communications amongst the Technical Committees (TCs) and Technical Subcommittees (STCs) of the European Telecommunications Standards Institute (ETSI). Further it is intended to form the platform for the development of European Telecommunication Standards (ETSs) and ETSI Technical Reports (ETRs).

The integrated scenario is intended to support the implementation of Private Telecommunication Networks (PTN) in such a way that the private and public network equipment co-operate in order to provide (PTN) services to the PTN users. This will result in better usage of the associated public network infrastructure, the privately owned network equipment and terminal equipment.

This TCR-TR applies to public and private network equipment that are involved in supporting the interconnection of Private Network Telecommunication Exchanges (PTNXs), and for the support of PTN services, Additional Network Features (ANFs) and management services. These services include services implemented in a standardized manner, and also non-standardized services.

This TCR-TR is related to the concept of "Virtual Private Network (VPN) services" in that the integrated scenario may be seen as a component. The definition of "VPN services" is outside the scope of this TCR-TR.

This TCR-TR considers the issues relating to the integrated scenario independent of the actual implementation in the public network.

This TCR-TR does not consider the emulation by the public network infrastructure of an end PTNX functionality (e.g., a centrex).

This TCR-TR does not consider issues relating to the harmonization of private network supplementary services and public network supplementary services.

2 References

This TCR-TR incorporates by dated or undated reference, provisions from other publications. These 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 TCR-TR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 189 (1992): "Private Telecommunication Network (PTN); Addressing".

[2] ETS 300 196-1 (1993): "Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[3] ETS 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface layer 3 specification for basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".

[4] ETS 300 415: "Private Telecommunication Network (PTN); Terms and definitions".

[5] ETR 076: "Integrated Services Digital Network (ISDN); Standards guide".

[6] TCR-TR 010 (1993): "Business Telecommunications (BT); Provision of connections for interconnecting Private Telecommunication Network Exchanges (PTNXs)".

[7] TCR-TR 018 (1994): "Private Telecommunication Network (PTN); General principles and service aspects".

[8] ENV 41006: "Scenarios for interconnections between exchanges of Private Telecommunication Networks".

[9] CCITT Recommendation E.164 (1991): "Numbering plan for the ISDN era".

[10] ITU-T Recommendation I.411 (1993): "ISDN user-network interfaces - reference configurations".

[11] ITU-T Recommendation I.570 (1993): "Public/private ISDN interworking".

[12] ISO/IEC 11579-1 (1994): "Information Technology - Private Integrated Services Network - Reference Configuration - Part 1: Reference Configuration for PISN Exchanges (PINX)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TCR-TR, the following definitions apply:

Additional Network Feature (ANF): This is a set of functions supporting services above those required for a basic call. The customer for these services can be any entity within the network, i.e. any entity other than a user (see ETS 300 415 [3]).

C reference point: The reference point between a PTNX and the InterVening Network (IVN) in a PTN.

call: An instance (of unspecified duration) of an invocation of a bearer service or a teleservice. In this TCR-TR this definition shall refer to circuit-mode calls only.

connection: This is a concatenation of transmission channels or telecommunication circuits, switching and other functional units, set up to provide for the transfer of information between two or more points in a telecommunication network (see ETS 300 415 [3]).

end-PTNX: This is the functionality of a PTNX required to provide attachment and servicing of terminals (see ETS 300 415 [3]).

external call: A particular type of call, incoming to, or outgoing from a given PTN through a public Integrated Services Digital Network (ISDN) with either a public user or another PTN.

gateway-PTNX: This is the functionality of a PTNX required to interconnect end-PTNXs or transit-PTNXs with nodes of other public or private networks (see ETS 300 415 [3]).

integrated scenario: This is a scenario in which PTNXs are interconnected by means of an InterConnecting Network (ICN) (see ETS 300 415 [3]).

Inter-PTNX Connection (IPC): This is a point-to-point connection between two PTNXs of a private telecommunication network to support inter-PTNX communication (see ETS 300 415 [3]).

NOTE 1: The information conveyed may be inter-PTNX signalling information or user information or both.

InterConnecting Network (ICN): This is the emulation of transit-PTNX functionality by equipment that is physically part of the public network equipment. In addition, it includes one or more IVNs and may include the emulation of gateway-PTNX functionality (see ETS 300 415 [3]).

InterVening Network (IVN): This is any means of providing IPCs for the purpose of interconnecting two or more PTNXs (see ETS 300 415 [3]).

Integrated Service Private Branch Exchange (ISPBX): This is an implementation of a PTNX located on the premises of a private network administrator (see ETS 300 415 [3]).

overlay scenario: This is a scenario in which the services provided by the PTN overlay any services of the network acting as the IVN (see ETS 300 415 [3]).

private: This is an attribute indicating that the application of the so qualified item, e.g. a network, a unit of equipment, a service, is offered to or is in the interest of a determined set of users. This attribute does not indicate any aspect of ownership (see ETS 300 415 [3]).

NOTE 2: The term does not include legal or regulatory aspects (see ETS 300 415 [3]).

PTN administrator: This is an authority responsible for the provision and management of a private telecommunication network (see ETS 300 415 [3]).

PTN user: A person or an application process which uses the services provided by a PTN.

PTN call: A call in which the calling and the called parties are users of the same PTN.

(PTN) Scenario: This is the arrangement of two PTNXs belonging to the same PTN (see ETS 300 415 [3].

Private Telecommunication Network eXchange (PTNX): This is a PTN nodal entity that provides automatic switching and call handling functions used for the provision of telecommunication services. A nodal entity may consist of one or more nodes. The nodal entity, performing the functions outlined above, can be implemented by equipment located on the premises of the private network administrator or by equipment collocated-located with, or physically part of, a public network (see ETS 300 415 [3]).

public: This is an attribute indicating that the application of the so qualified item, e.g. a network, a unit of equipment, a service, is offered to the general public. This attribute does not indicate any aspects of ownership (see ETS 300 415 [3]).

NOTE 3: The term does not include legal or regulatory aspects (see ETS 300 415 [3]).

T reference point: Refer to ITU-T Recommendation I.411 [10].

transit-PTNX: This is the functionality of a PTNX required to interconnect end-PTNXs and/or other transit-PTNXs and/or gateway-PTNXs (see ETS 300 415 [3]).

user: This is an entity using the services of a network via terminal equipment (see ETS 300 415 [3]).

NOTE 4: A user may be a person or an application process.

3.2 Abbreviations

For the purposes of this TCR-TR, the following abbreviations apply:

ANF	Additional Network Feature
CC	Call Control
CCA	Call Control Agent
CH	Call Handling functionality
FE	Functional Entity
GW	Gateway functionality
IAF	ICN Access Function
IANF	ICN Access Node Function
ICF	ICN Control Function
ICN	InterConnecting Network
IMF	ICN Management Function
IMUF	ICN Management User Function
IPC	Inter-PTNX Connection
ISPBX	Integrated Services Private Branch eXchange
ISRA	ICN Service Requesting Agent
IVN	InterVening Network
MP	Mapping functionality
PICS	Protocol Implementation Conformance Statement
PTN	Private Telecommunication Network
PTN-ID	PTN-IDentity
PTNX	Private Telecommunication Network eXchange
SW	Switching functionality
TMN	Telecommunications Management Network
VPN	Virtual Private Network

4 Introduction

A PTN may consist of one or more PTNXs (see TCR-TR 018 [7] and ENV 41006 [8]). The arrangement of PTNXs and the means of interconnecting them is called a (PTN) scenario. The scenarios are classified as "overlay scenario" or "integrated scenario". These scenarios are described in subclauses 4.1 and 4.2.

This TCR-TR is concerned with PTN scenarios, called "integrated scenarios" that are characterized by the public network infrastructure providing (PTN) transit switching and routeing functions in addition to the transmission function (provided by the IVN).

By contrast, if in the so called "overlay scenario", a public ISDN is employed, then it provides only transmission functions (i.e., an IPC) and is consequently considered to be an IVN.

The PTN user will not generally be aware of the scenario employed by the PTN during service invocation.

4.1 Overlay scenario

In the overlay scenario the IVN plays no part in the establishment of PTN calls (i.e., instances of basic and supplementary services), although it does provide IPCs. The "overlay scenario" is described in detail in TCR-TR 010 [6], TCR-TR 018 [7] and ENV 41006 [8]. The overlay scenario is mentioned here for completeness and comparison, but it is outside the scope of this TCR-TR.

An overlay scenario exhibits the following characteristics:

a) PTNXs are interconnected via IPCs that provide transmission of signalling and user information. These IPCs are provided by an IVN at the C reference point and may be established permanently, semi-permanently or on-demand basis ("switched");

b) in the "on-demand case", multi-step call and connection establishment is required, i.e.:

- establishment of PTN signalling connection between PTNXs using the bearer service provided by the IVN;
- establishment of signalling relations (QSIG family) between the PTNXs;
- establishment of PTN user information connection using the bearer services provided by the IVN and completion of PTN calls;

c) the intra-PTN Call Control (CC) information is mapped onto a user plane of the IVN and is thus transparent to the IVN;

d) for PTN services, at stage 2 description, no Functional Entities (FEs) can be allocated to the IVN (except those which are used for providing IPCs).

NOTE: The IVN may provide an IPC by, for example:

- as leased lines, semi-permanent connections, or other forms of dedicated transmission services; or
- as switched connections established as a normal public call using normal protocols supported by the IVN. Some of the supplementary services provided by the IVN may be used as an integral part of these connections.

4.2 Integrated scenario

The public network equipment provides switching and routeing functions and it may also provide other PTN service execution functions. This functionality is called ICN.

An integrated scenario exhibits the following characteristics:

a) bearer services and teleservices offered by the PTN must be supported by an ICN such that the ICN responds to the service request by establishing a suitable (bearer) connection to the destination PTNX. The ICN shall deliver the service request to the destination PTNX;

NOTE 1: The intra-PTN CC information uses the control plane of the ICN. Thus, the establishment of an inter-PTNX call requires only a single step procedure.

b) the ICN may provide functionality for the support of one or more PTN supplementary services. If the ICN does not provide functionality for the support of a particular supplementary service, the ICN shall transfer signalling information related to that service between the connected PTNXs without modification. See also note 2;

NOTE 2: In contrast to the behaviour of the public network equipment providing public ISDN services, an ICN must not discard or reject service control information which it cannot process, but it shall forward it to the next PTNX.

This aligns with the service execution principle specified for PTNs, allowing PTNXs of different degrees of service implementation to smoothly co-operate in a PTN.

c) the ICN may provide functions to support external calls;

d) the ICN may provide management services to facilitate control by the PTN administrator of the ICN functions;

e) the ICN may support PTN specific charging functions in such a way that the charging principles (e.g. the charging rates) for PTN traffic may differ from normal public charges.

5 Architecture

The architectural diagrams given in this TCR-TR model the ICN interconnected with PTNXs. Although these diagrams show PTNXs which are implemented as ISPBXs, the model does not preclude that end-PTNXs can be implemented using public network equipment. In this case a physical interface between such end-PTNXs and the ICN may not exist, although the same information flows may exist.

Public network equipment can support the interconnection of PTNXs (see figure 1) in three different ways:

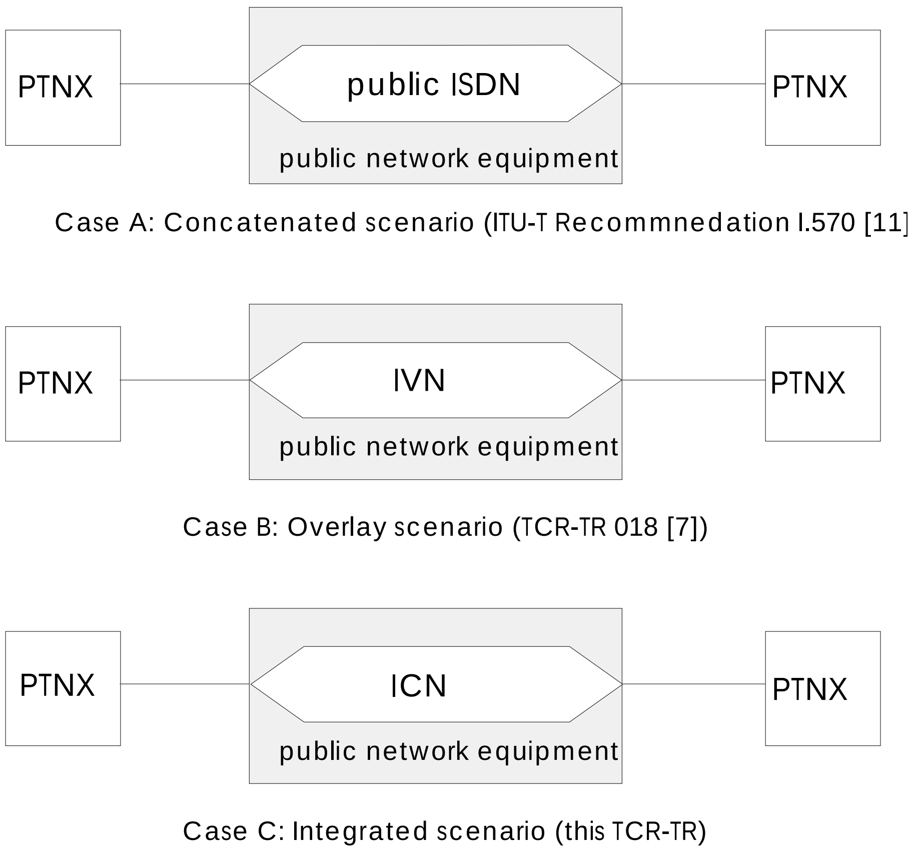


Figure 1: Public ISDN, ICN and IVN supported by the public network equipment

Case A: Concatenated scenario

ITU-T Recommendation I.570 [11] describes the mode of interconnection via a public ISDN as a concatenation scenario. The concatenation scenario requires interworking of services of the public ISDN with those of the PTN, and vice versa, at the T reference point. The services provided to PTNX users on connections over this scenario correspond to the lowest common denominator of the public and private network services. The PTNXs at either side of the public ISDN need not belong to the same PTN.

The concatenation scenario is mentioned here for completeness, but is outside the scope of this TCR-TR.

Case B: Overlay scenario

The IVN corresponds to an overlay scenario. See TCR-TR 010 [6], TCR-TR 018 [7] and ENV 41006 [8].

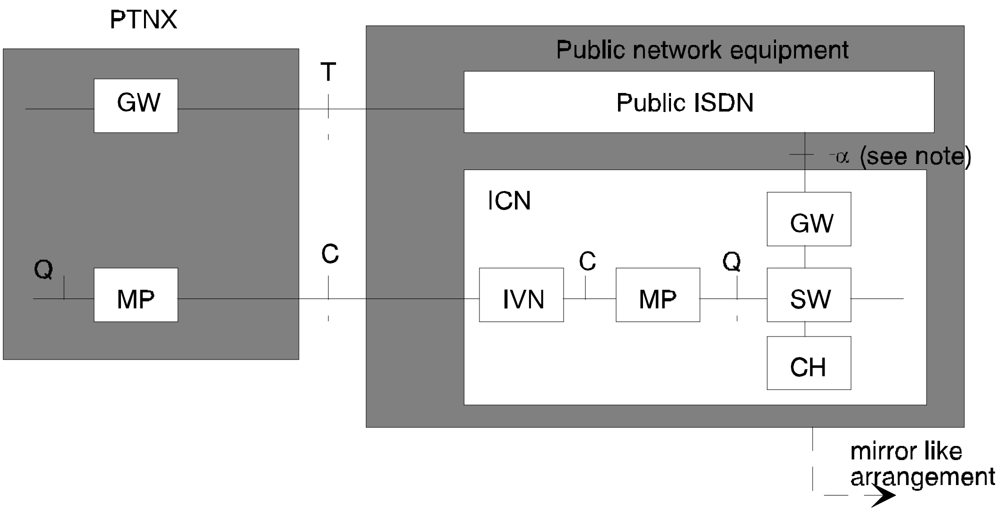
NOTE: In general, an overlay scenario does not limit an IVN to be provided by public network equipment. However, for comparison reasons within this TCR-TR, this limitation is expressed in figure 1.

Case C: Integrated scenario

Two approaches to the integrated scenario are recognized as being valid. These are described in subclauses 5.1 to 5.3.

5.1 Adaptation of the PTNX reference configuration to the integrated scenario

Figure 2 illustrates an adaptation of the "PINX reference configuration" (see ISO/IEC 11579-1 [12]) as applied to the integrated scenario. The infrastructure of the ICN consists of a Mapping functionality (MP) grouping and a Switching functionality (SW) grouping implemented by public network equipment in such a way as to emulate a transit PTNX. In addition, the Call handling functionality (CH) grouping provides service logic for the handling of PTN calls (e.g. call screening, authentication procedures). The ICN may also provide a Gateway functionality (GW) grouping that allows calls to enter or exit the PTN from/to the public ISDN.



NOTE: α defines the boundary between the ICN and the public ISDN, in particular with regard to:

- numbering;
- charging;
- management;
- routeing, etc.

A standardized physical interface is not required at α. This means that there is:

- no need for a defined access structure;
- no transmission system required;
- no Layer 1 and no Layer 2 specifications etc. required.

Figure 2: Adaptation of the PTNX reference configuration

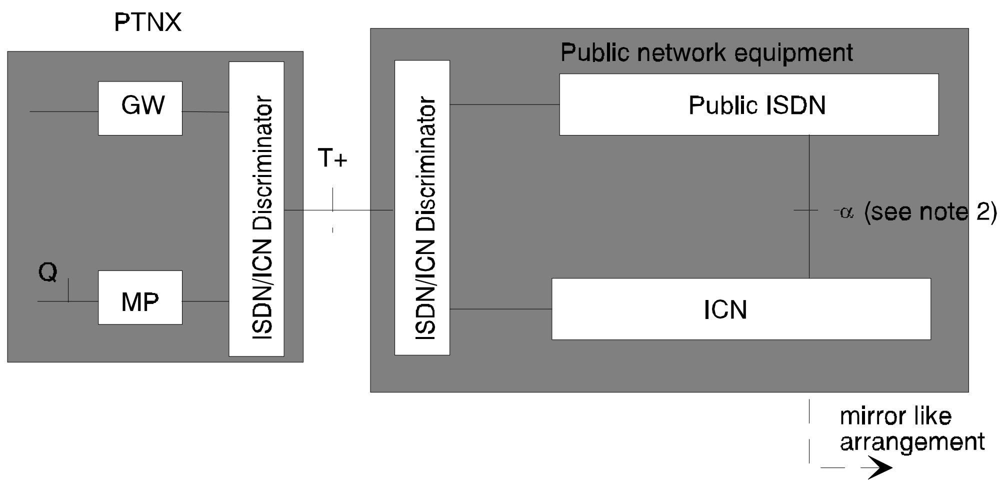
Depending on the implementation, some functional groupings such as IVN may be NULL.

The MP functional grouping provides a static mapping of the logical channel to physical channels in the interface(s) coincident with the C reference point.

The T reference point and C reference point can coexist on the same physical interface. Signalling aspects are dealt with in clause 8.

5.2 Reference configuration for integrated scenario using a new reference point

Figure 3 shows a further development of the "PINX reference configuration" (see ISO/IEC 11579-1 [12]) for the integrated scenario that provides for access to the ICN and the public ISDN via a new reference point. Contrary to accessing the public network equipment via the T reference point for using the public ISDN and the C reference point for using an ICN, this configuration proposes a reference point in which PTN information flows are supported in addition to the information flows defined for the T reference point. The reference point for this new access is indicated in figure 3 as T+.



NOTE 1: The operation of the ISDN/ICN Discriminator may affect the functionality of the ICN, thus no functionality is shown within the ICN.

NOTE 2: α defines the boundary between the ICN and the public ISDN, in particular with regard to:

- numbering;
- charging;
- management;
- routeing, etc.

A standardized physical interface is not required at α. This means that there is:

- no need for a defined access structure;
- no transmission system required;
- no Layer 1 and no Layer 2 specifications etc. required.

Figure 3: Enhancements of the PTNX reference configuration for the integrated scenario

The ICN co-operates with the customer equipment so as to provide transit functionalities and service logic for PTN calls. Other aspects to be noted from figure 3 are:

a) the T+ reference point is used to signify a reference point between the discriminating functions "ISDN/ICN Discriminator" residing in the PTNX and in public network equipment.

The physical characteristics of an interface at the T+ reference point should be those of the standardized user access to the public network. The control plane carries the signalling information flows of the public ISDN (specified for the T reference point) and the PTN (specified for the Q reference point);

b) the ISDN/ICN Discriminator in the public network equipment distinguishes on a per call basis between whether the connection is via the public ISDN or the ICN. This means that it has to allocate the signalling information flows to the control plane of either the public ISDN or the ICN. If the ISDN/ICN Discriminator determines that a signalling information flow belongs to the ICN, further functions will be invoked in the ICN. For example, analysis of the called party number encoded as "Unknown" or "PNP" (as provided in the PTN signalling information flows) in order to derive the necessary data for routeing within the ICN;

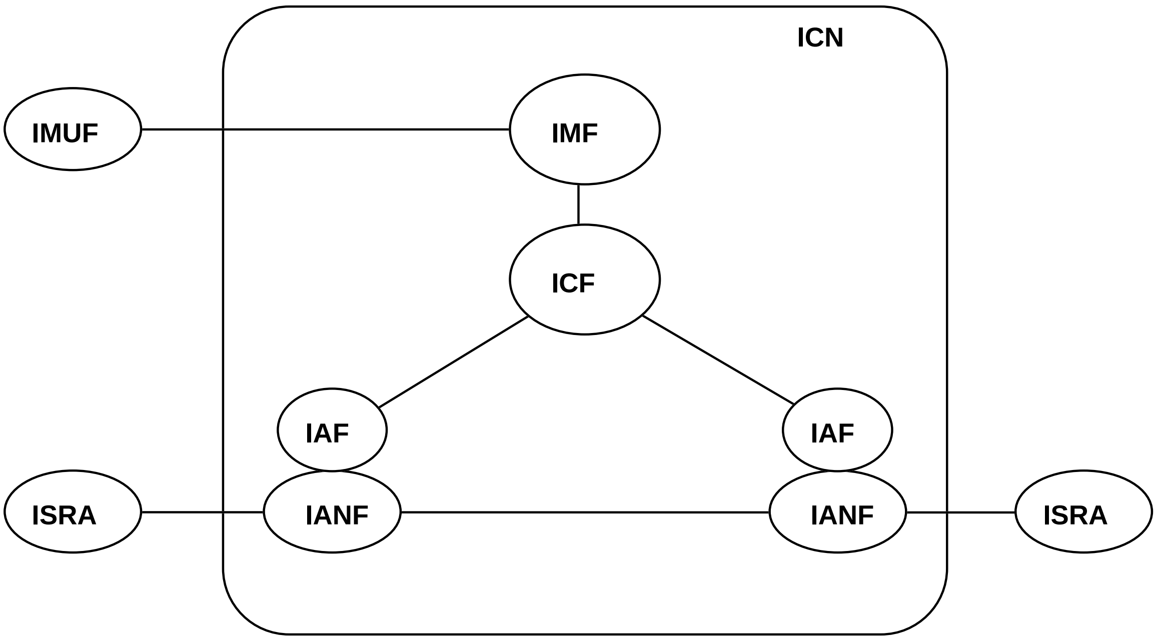
c) where calls are delivered to a PTNX, it shall be possible for the PTNX to distinguish between PTN calls and external calls;

d) not withstanding the two different signalling information flows across the interface, the user information channels at the T+ reference point are dynamically allocated at either side of the interface.

5.3 Functional model for the ICN

This clause describes a possible functional model for the ICN. This model, illustrated in figure 4, shows FEs from an ICN service provisioning point of view, whereas figures 2 and 3 model the ICN functional groupings as perceived by the connected PTNXs.

The model of figure 4 is applicable to both approaches described in subclauses 5.1 and 5.2.



IANF ICN Access Node Function;
IAF ICN Access Function;
ICF ICN Control Function;
IMF ICN Management Function;
IMUF ICN Management User Function;
ISRA ICN Service Requesting Agent.

NOTE: The functional model does not necessarily imply the adoption of IN methodologies for the specification of ICN services.

Figure 4: ICN functional model

The purpose of the integrated scenario functional model is to identify the FEs involved in the ICN functionality in the public ISDN.

The integrated scenario functional model is composed of the following FEs.

5.3.1 ICN Service Requesting Agent (ISRA)

The ISRA interacts with the ICN functionality on behalf of PTN users.

5.3.2 ICN Access Node Function (IANF)

The IANF in the public ISDN provides processing and control functionality for basic call and supplementary services, and access to the ICN Access Function (IAF). Its functionality can be divided in two sets.

The first set consists of ISDN functions:

- control of circuit and signalling connections;
- execution of supplementary services.

The second set consists of additional functions required to support the ICN:

- discrimination between external calls and PTN calls;
- triggering of specific procedures for the processing of PTN calls which may require a dialogue with the IAF;
- the capability to process or route supplementary service signalling information to the relevant remote entity (e.g. an ISRA for an end-to-end PTN service, or the ICN Control Function (ICF) for an ICN specific service).

5.3.3 ICN Access Function (IAF)

The IAF, associated with the IANF, provides the set of functions required for interaction between the IANF and the ICF. It:

- manages signalling between the IANF and the ICF;
- transmits ICN service requests made by the IANF for the processing of PTN calls and/or ICN specific supplementary services to the ICF;
- modifies call/connection as well as supplementary services processing in the IANF as required by the ICN control function.

5.3.4 ICN Control Function (ICF)

The ICF controls IANFs in order to route PTN calls through the ICN to their destination and provide ICN specific supplementary services. It:

- interfaces and interacts with the IAF and ICN Management Function (IMF) FEs;
- contains the logic, data and processing capability required to handle the ICN functionalities. The following examples are given for clarity purposes:

  a) user access rights control;
  b) routing according to a private number in the public ISDN;
  c) ICN specific supplementary services such as optimized call forwarding or call transfer.

5.3.5 ICN Management User Function (IMUF)

The IMUF provides access to PTN management data for the PTN manager in order to modify the data.

5.3.6 ICN Management Function (IMF)

The IMF supports the management of ICN user and network information. It:

- interfaces with the ICF in order to modify ICN configuration data and to retrieve charging and traffic data;
- interfaces and interacts with the IMUF in order to provide management services.

The FEs identified in the integrated scenario functional model can be grouped in physical entities in several ways which will define a physical architecture for the ICN.

5.4 Stage 2 FE relationships

Various stage 2 FEs can be allocated to the ICN for the provision of PTN services.

An example illustrating the allocation of basic call FEs is given in annex A.

6 Numbering

Each PTN administrator may choose the numbering plan of its PTN according to ETS 300 189 [1]. Each PTN will have its own PTN numbering plan which may be either:

- a Private Numbering Plan (PNP), as specified in ETS 300 189 [1]; or
- a context specific numbering plan ("unknown"); or
- the public ISDN numbering plan (CCITT Recommendation E.164 [9]); or
- a combination of the above alternatives.

The PTN numbering plan is the generic designation for the numbering plan(s) chosen as native by a PTN administrator for its particular PTN. A PTN number is a number valid in the domain covered by a PTN numbering plan.

Three main functions are to be supported by an ICN. They are:

- derivation of routeing information from called party number information offered to it in PTN numbering plan formats;
- preservation of the integrity of the called party number information independently of its call processing with regard to the numbering format (i.e. PTN numbering plan);
- provision of mechanisms for handling multiple instances of PTNs and for distinguishing between them.

6.1 Derivation of routeing information

Routeing information is usually derived from the called party number. However, according to the statements above, the use of the type of numbering plan information (which is provided with the called party number) is not sufficient to discriminate between PTN calls and external calls in the case where the PTN uses the CCITT Recommendation E.164 [9] numbering plan as a native numbering plan for PTN calls. Specific mechanisms should be developed to meet such a requirement.

6.2 Preservation of PTN number integrity

The ICN performs intra-PTN CC. Although the routeing information derived from PTN numbers can be in a format compatible with public network equipment, the ICN only alters the numbering format (i.e. the numbering plan identifiers and/or the type of number values) for selection and identification numbers in accordance with the PTN administrator's definition for that particular transit PTNX.

6.3 Distinction between different PTNs

The usage of PTN-IDentities (PTN-IDs) can serve three purposes:

1) the ICN needs to be able to distinguish between multiple instances of PTNs. Any identification mechanism is internal to the ICN;

2) there may be PTN configurations in which the same physical equipment support calls belonging to different logical PTNs. In some cases, a PTN user could be a member of more than one PTN. These cases may require the interchange of a PTN-ID between the PTNX and the ICN. In this context the PTN-ID has local significance between the PTNX and the ICN;

3) the integrated scenario may be supported by the co-operation of multiple ICN providers. This may require the interchange of a PTN-ID between ICNs. This PTN-ID must be understood unambiguously by the involved ICN providers. In this context, the PTN-ID has significance only at the boundary between multiple ICNs.

The PTN identifiers that may be used for these three purposes need not have equal values.

Where a PTN-identity can be determined implicitly, there is no requirement to use a PTN-ID.

In addition, there will be cases (e.g. carrier selection) where it is necessary to add to this PTN-ID additional information to identify the ICN provider required.

7 Service considerations

For a list of standardized services, see ETR 076 [5].

The following services considerations apply to ICNs:

a) as far as PTN services (basic or supplementary) are concerned, the ICN's potential involvement is described in the appropriate specifications of the individual services. This information is provided by the stage 2 allocation of FEs and in the Protocol Implementation Conformance Statement (PICS) contained in the stage 3. As a minimum the ICN is required to support the transit PTNX functions for basic services. The ICN may also support functions for the individual supplementary services. The actual involvement will furthermore depend on the particular implementation of the ICN.

   Extension of some existing standards for PTN supplementary services may be required. In the current standards most of the functionality is allocated to the end-PTNXs. Where appropriate the extended standards should specify additional allocation scenarios in which more functionality is allocated to the ICN that acts as a transit-PTNX. The standards should address the stage 2 and stage 3 specifications.

   Further studies may be required to specify generic mechanisms that make ICN services easily available to PTN users. ICN services are standardized or non-standardized PTN services for which functionality is mostly allocated to the ICN. An easy access to ICN services may have impact on the end-PTNXs to which PTN users are connected;

b) the same principle applies to PTN ANFs whose "users" consist of entities in the PTNXs. Examples of such ANFs are enhanced routeing capabilities such as path replacement;

c) as far as transit PTNX functionality is concerned, the ICN does not provide services by itself, but it can be involved in the provisioning of services;

d) with regard to internal functionality of the ICN, it may have to provide additional capabilities to those that are required to handle a basic call which are neither visible to the PTN user nor to the end-PTNXs' management entities. Some examples of these internal capabilities (they may be implemented as ANFs) are: the support of PTN numbering plans, and to distinguish between multiple instances of PTNs or PTN numbering plans. See also clause 6;

e) the ICN can provide management services that are visible to and accessible by PTN management centres.

The following subclauses identify additional considerations applicable to the ICN.

7.1 User services

In addition to the support of standardized PTN services, the ICN may be involved in that of other services some examples of which are given below.

7.1.1 Off-network access to a PTN

This service allows a PTN user to access its own PTN from any public network access. The ICN performs identification control and possible authentication. The user is then able to request any PTN service, however the service execution may be restricted by the terminal capabilities and the public ISDN to ICN interworking functionality limitations. The call may be charged on the PTN account number.

7.1.2 Support of manufacturer specific PTN-services

The ICN should be able to transport control information transparently for execution of manufacturer specific services, within a reasonable size limit.

7.2 PTN ANFs

The ICN may incorporate functions (FEs) for the support of ANFs. An example is given below.

NOTE: The support of inter-PTN communication via the ICN is beyond the scope of this TCR-TR.

7.2.1 Outgoing call screening

The ICN may provide centralized outgoing call screening to enable the network administrator to control the access to specific called destinations on a per PTN user basis.

7.3 ICN internal ANFs

7.3.1 Support of PTN numbering plan

Numbering services provided by ICN providers will, as a minimum, meet the requirements of ETS 300 189 [1].

7.3.2 Support of external calls

The architectural model in figures 2 and 3 enables calls from users in the PTN to users in the public ISDN (and vice versa) to be routed via the ICN. A PTN user (or originating PTNX) may be able to determine at which gateway this will occur.

7.3.3 Private routeing plans

The ICN may support private routeing plans and mechanisms such as "least cost routeing", preferred transmission medium (e.g. satellite or cable), time dependant routeing and other arrangements to support particular routeing requirements in private networks.

7.3.4 Traffic control

The ICN should have a mechanism to control traffic volume between PTNXs. This may apply both for user and signalling information.

This traffic control can be used both to limit the overall volume and to provide a guaranteed grade of service and may be enabled through signalling or management.

7.3.5 Access security

The ICN should provide a security mechanism to protect, for example, each PTN against invasions of privacy.

7.4 Management services

The ICN is considered to be a part of the PTN, and thus the PTN administrator may require access to the PTN management functions of the ICN. In principle, this access can also be delegated to one or more third party, but it needs to remain under the control of the PTN administrator.

As the ICN is physically a part of the public network infrastructure co-operation is required between the management systems of the PTN and those parts of the public network management system that control the ICN.

The ongoing standardization work within ETSI NA4, ITU-T Q5/IV and ECMA TC32-TG12 related to Telecommunications Management Network (TMN) should be broadened to include the shared management of the ICN.

7.4.1 Statistics

Information related to calls that are processed by the ICN such as call records and call statistics may be supplied to the PTN administrator. The format of the information and supply mechanisms are beyond the scope of this TCR-TR.

7.4.2 Configuration management

Management of PTN configuration data in the ICN may be performed by the ICN service provider and/or by the PTN administrator. The PTN administrator may have access to the following management functions related to configuration data stored in the ICN:

- PTN configuration data;
- private numbering plan and routeing configuration;
- allocation of physical resources; and
- service provisioning data, e.g. related to variable destination.

A PTN administrator may as a subscription option be given access to different management functions in the ICN for the management of all or a limited set of the configuration data in the ICN. There may also be different restrictions on access to the data, e.g., to read only, or modify allowed.

Offering of customized recorded announcements to PTN administrator

This service allows the PTN administrator to define different announcements for particular call conditions, for instance, unsuccessful call completion due to different reasons (e.g. all lines engaged, called party not available at that time of the day, calling party not authorized to make that kind of call, etc.).

The PTN administrator should be able to specify the contents of each announcement (e.g. to give special instructions to users) as well as the conditions on which the announcement is to be invoked. Announcements are recorded in co-operation with the public network administrator.

This service will also be responsible for establishing internal routeing conditions so that the announcement may be given to appropriate PTN calls.

NOTE: The function or feature that activate the announcement is not a part of this service.

7.4.3 Maintenance

Maintenance of PTN resources in the ICN may be performed by a PTN administrator and/or the ICN service provider. The PTN administrator may have access to several functions for maintenance of resources in the ICN. Some examples are:

- performance verification of the ICN resources. This includes management of routine test and statistical reports;
- fault management; and
- alarm handling.

8 Signalling and interface aspects

As described in clause 5, two equally valid, non-exclusive, options can exist:

- T reference points and C reference points reside on different interfaces or on the same interface with some static pre-arrangements; and/or
- a T+ reference point resides, instead, on a common interface with dynamic B-channel allocation and with public or private network service requests on a per-call basis.

These two approaches are described in subclauses 8.1 and 8.2.

The two options have local significance only.

If the option of T reference points and C reference points residing on different interfaces or the same interface with some static pre-arrangements is employed, the TSIG and QSIG information flows are inherently kept separate and can easily be routed to the appropriate functions at either side of the boundary.

If the option of a T+ reference point residing on a common interface is employed, measures need to be developed to support the capability of the TSIG and QSIG information flows and to route PTN calls and external calls on a per-call basis.

It is recognized that implementations of the integrated scenario already exist using other protocols. Where these existing implementations interwork with networks implemented in accordance with ETSI standards for the integrated scenario, these existing implementations will need to provide appropriate interworking functions. It is not recommended that ETSI should produce interworking standards in this area.

8.1 QSIG implementation across the boundary between the PTNX and public network equipment

8.1.1 T reference point and C reference point use separate interfaces

Both basic access and primary rate access structures can be employed. QSIG will be used on those interfaces which are allocated to invoke the ICN capabilities of the public network equipment.

8.1.2 T reference point and C reference point use the same interface with predetermined allocation of B-channels and separation of QSIG and TSIG on different signalling channels

Only the primary rate access should be used for accommodating T reference points and C reference points on the same interface.

TSIG should be conveyed on time slot 16. The allocation of QSIG should be possible on any other time slot, subject to mutual agreement between the private and public network operators.

8.1.3 T reference point and C reference point use the same interface with predetermined allocation of B-channels and separation of QSIG and TSIG on the same signalling channel

Both basic access and primary rate access structures can be employed. The means for the distinguishing between QSIG and TSIG and for invoking either the public ISDN or the ICN functions of the public network equipment are for further study. Mechanisms that may be used include layer 2 multiplexing, B-channel indication or different protocol discriminators.

8.2 Combination of TSIG and QSIG

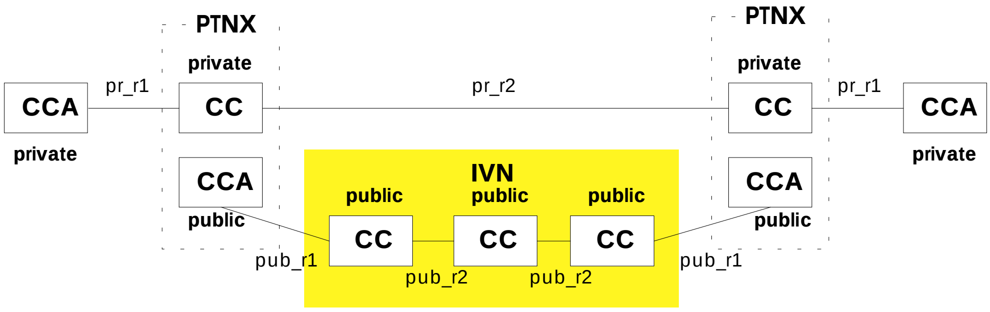
The interface at the T+ reference point supports the functionality of an ISDN interface at the T reference point and in addition the functionalities of the QSIG protocol. The protocol should be available on basic access and primary rate access and allow for dynamic B-channel allocation.

The protocol to be used should be based on DSS1/Q.931 (see ETS 300 403-1 [3]) and DSS1/Q.932 (see ETS 300 196-1 [2]) which should be enhanced in order to provide QSIG functionalities, both for basic call and for supplementary services, while remaining compatible with former versions of DSS1.

Annex A: Support of IVNs and ICNs by means of stage 2 FEs

The ICN actively participates in the provision of PTN services. This can be demonstrated by comparing its provisioning of FEs and their involvement in PTN service execution with that of an IVN.

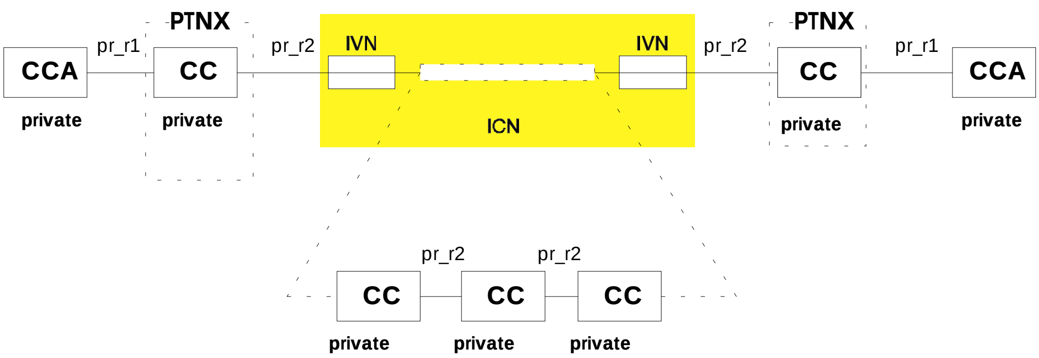
Figures A.1 and A.2 illustrate the involvement of public equipment, in terms of stage 2 basic FEs in supporting an IVN or an ICN. The prefix "pr" identifies PTN FEs and relationships, and the prefix "pub" identifies public FEs and relationships. The figures show physical locations where the FEs may be allocated.



Key: prefix "pr" identifies PTN FEs;
prefix "pub" identifies public network FEs.

Figure A.1: Involvement of public network equipment in an IVN

For the IVN, the PTNX acts as a Call Control Agent (CCA) FE and sends service requests and receives service indications from the IVN's CC FE to establish the IPC. PTN FEs shall not and cannot be allocated to the IVN. Any coordination between the pr_CC and pub_CCA allocated to the same PTNX, is considered to be a management function.



Key: prefix "pr" identifies PTN FEs;
prefix "pub" identifies public network FEs.

Figure A.2: Involvement of an ICN in PTN service provision

In the ICN context, CCs of the public network equipment form part of the overall chain of PTN CCs and act as transit CCs in providing PTN services to the PTN user. Incoming and outgoing gateway CCs must be allocated to the ICN in the case the ICN provides a GW at a T reference point to the public ISDN.

Between the FEs allocated in the private and public network equipment only one integrated relationship is identified. This relationship should be equal to the relationship pr_r2 which is specified between PTN CC FEs. The ICN encompasses FEs that are part of the PTN and are allocated to the public network equipment. For the integrated scenario the present specification of private as well as public FEs and relationships needs to be reconsidered.

History

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