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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Next Generation Networks – Service aspects: Interoperability of services and networks in NGN

PSTN/ISDN evolution to NGN

ITU-T Recommendation Y.2261

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ITU-T Recommendation Y.2261

PSTN/ISDN evolution to NGN

Summary

This Recommendation describes principle aspects of evolving PSTN/ISDN to NGN. Evolution of PSTN/ISDN to NGN, based on IP multimedia sub-system (IMS-based) and call server, (CS-based) is described. It mainly describes evolution of transport parts of PSTN/ISDN to NGN. Some evolution scenarios are also provided in appendices.

Source

ITU-T Recommendation Y.2261 was approved on 13 September 2006 by ITU-T Study Group 13 (2005-2008) under the ITU-T Recommendation A.8 procedure.

Keywords

Access gateway, Access network, Application server, Call server, Evolution, ISDN, NGN, PSTN.

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PSTN/ISDN evolution to NGN

1 Scope

A public switched telephone network or integrated services digital network (PSTN/ISDN) being one of the networks in telecommunication is considered to be a prime candidate for evolution to the next generation network (NGN) [Y.2001] and [Y.2011]. Because of the widespread deployment and the use of PSTN/ISDN, evolution to NGN should be considered as a step-wise approach.

This Recommendation describes possible ways of evolving PSTN/ISDN to NGN. Both the IP multimedia sub-system (IMS-based) and call server (CS-based) are described. It describes aspects, which need to be considered including evolution of transport, management, signalling and control parts of PSTN/ISDN to NGN. Evolution scenarios are also provided in appendices.

Administrations may require operators and service providers to take into account national regulatory and national policy requirements in implementing this Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[G.964] ITU-T Recommendation G.964 (2001), *V-interfaces at the digital local exchange (LE) – V5.1 interface (based on 2048 kbit/s) for the support of access network (AN)*.

[G.965] ITU-T Recommendation G.965 (2001), *V-interfaces at the digital local exchange (LE) – V5.2 interface (based on 2048 kbit/s) for the support of access network (AN)*.

[I.610] ITU-T Recommendation I.610 (1999), *B-ISDN operation and maintenance principles and functions*.

[M.3010] ITU-T Recommendation M.3010 (2000), *Principles for a telecommunications management network*.

[M.3400] ITU-T Recommendation M.3400 (2000), *TMN management functions*.

[Q.310-Q.332] ITU-T Recommendation Q.310-Q.332 (1988), *Specifications of signalling system R1*.

[Q.400-Q.490] ITU-T Recommendation Q.400-Q.490 (1988), *Specifications of signalling system R2*.

[Q.931] ITU-T Recommendation Q.931 (1998), *ISDN user-network interface layer 3 specification for basic call control*.

[Q.1741.3] ITU-T Recommendation Q.1741.3 (2003), *IMT-2000 references to release 5 of GSM evolved UMTS core network*.

[Q.1912.5] ITU-T Recommendation Q.1912.5 (2004), *Interworking between Session Initiation Protocol (SIP) and Bearer Independent Call Control protocol or ISDN User Part*.

[X.462] ITU-T Recommendation X.462 (1996), *Information technology – Message Handling Systems (MHS) Management: Logging information.*

[Y.1411] ITU-T Recommendation Y.1411 (2003), *ATM-MPLS network interworking – Cell mode user plane interworking*.

[Y.1541] ITU-T Recommendation Y.1541 (2006), *Network performance objectives for IP-based services*.

[Y.1710] ITU-T Recommendation Y.1710 (2002), *Requirements for operation & maintenance functionality for MPLS networks.*

[Y.2001] ITU-T Recommendation Y.2001 (2004), *General overview of NGN.*

[Y.2011] ITU-T Recommendation Y.2011 (2004), *General principles and general reference model for Next Generation Networks*.

[Y.2271] ITU-T Recommendation Y.2271 (2006), *Call server based PSTN/ISDN emulation.*

[TS 122 115] ETSI TS 122 115 v6.7.0 (2006), *Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Service aspects; Charging and billing*.

3 Definitions

This Recommendation defines the following terms:

NOTE – In this clause, [aaa] notation after title of a term indicates source of the definition for that term.

3.1 access gateway (AG): A unit that allows end users with various accesses (e.g., PSTN, ISDN, V5.x) connection to the packet node of NGN.

NOTE – The AG may be embedded in an access node, which also serves other access interfaces (e.g., xDSL, LAN). Such access nodes are also known as multi-service access nodes (MSAN).

3.2 access network (AN): See [G.964].

3.3 accounting: See [X.462].

3.4 application: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

3.5 application server (AS) [Y.2271]: A unit that interacts with the call server and the user profile server to support service execution.

3.6 billing: See [Q.1741.3].

3.7 call server (CS) [Y.2271]: The core element of a CS-based PSTN/ISDN emulation component which is responsible for call control, media resource control, call routing, user profile and subscriber authentication, authorization and accounting. Depending on its role, the behaviour of the call server may be different. In these cases, the role of the call server is identified, for example, as "Access call server", "Breakout call server", "IMS call server", "Routing call server" or "Gateway call server".

3.8 charging: See [Q.1741.3].

3.9 evolution to NGN: A process in which whole or parts of the existing networks are replaced or upgraded to the corresponding NGN components providing similar or better functionality, while attempting to maintain the services provided by the original network and the possibility of additional capabilities.

3.10 gateway: A unit that interconnects different networks and performs the necessary translation between the protocols used in these networks.

3.11 media server (MS) [Y.2271]: A network element providing the media resource processing function for telecommunication services in NGN.

3.12 remote user access module (RUAM): A unit that physically terminates subscriber lines and converts the analogue signals into a digital format. The RUAM is physically remote from the local exchange.

3.13 signalling gateway (SG): A unit that provides out-of-band call control signalling conversion between the NGN and other networks (e.g., between a call server in NGN and an STP or SSP in SS7).

3.14 trunking media gateway (TMG): A unit that provides interfaces between the packet nodes of the NGN and the circuit-switched nodes (e.g., transit exchange, local exchange, international exchange) of PSTN/ISDN for bearer traffic. The TMG provides any needed conversion to the bearer traffic.

3.15 user access module (UAM): A unit that physically terminates subscriber lines and converts the analogue signals into a digital format. The UAM is collocated with a local exchange, and is connected to the local exchange.

4 Abbreviations

This Recommendation uses the following abbreviations:

ACS Access Call Server

AG Access Gateway

AN Access Network

API Application Programming Interface

AS Application Server

ATM Asynchronous Transfer Mode

BCS Breakout Call Server

BICC Bearer Independent Call Control

CAS Channel Associated Signalling

CCS Common Channel Signalling

CDR Call Detail Record

CS Call Server

CT Content of Telecommunication

DSL Digital Subscriber Line

DSLAM Digital Subscriber Line Access Multiplexer

DSS1 Digital Signalling System No. 1

DTMF Dual Tone Multi Frequency

ETS Emergency Telecommunications Services

FTTC Fibre-To-The-Curb

FTTH	Fibre-To-The-Home
GCS	Gateway Call Server
ICS	IMS Call Server
IMS	IP Multimedia Subsystem
IN	Intelligent Network
INAP	Intelligent Network Application Part
IP	Internet Protocol
IPTV	IP Television
IRI	Intercept-Related Information
ISDN	Integrated Services Digital Network
IVR	Interactive Voice Response
LE	Local Exchange
LEA	Law Enforcement Agencies
MS	Media Server
MSAN	Multi-Service Access Node
NGN	Next Generation Network
N-ISDN	Narrowband ISDN
OSS	Operations Support System
PBX	Private Branch eXchange
PLMN	Public Land Mobile Network
POTS	Plain Old Telephone Service
PSAP	Public Safety Answering Point
PSN	Packet Switched Network
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RCS	Routing Call Server
RUAM	Remote User Access Module
SCE	Service Creation Environment
SCP	Service Control Point
SG	Signalling Gateway
SIP	Session Initiation Protocol
SS7	Signalling System No. 7
SSF	Service Switching Function
SSP	Service Switching Point
STP	Signalling Transfer Point
TDR	Telecommunications for Disaster Relief
TE	Transit Exchange

TMG Trunking Media Gateway

UAM User Access Module

URI Uniform Resource Identifier

VoD Video on Demand

VoIP Voice over IP

xDSL any DSL

5 Conventions

None.

6 PSTN/ISDN evolution to NGN

The PSTN/ISDN is the prime candidate for evolution to NGN and, as such, all aspects should be carefully examined and appropriate measures should be taken.

In general, PSTN/ISDN is comprised of the following entities, each with one or multiple functionalities:

- Transport (access plus core): user access module (UAM), remote user access module (RUAM), access network (AN) via V5.1/2 [G.964] and [G.965] interface connected to the core switches and the core switches themselves.
- Control and signalling: exchange hosts.
- Management: management of exchanges.
- Service: exchange hosts and auxiliary network (e.g., IN).

In PSTN/ISDN, most of the functionalities are located in a single exchange and may use proprietary protocols. However, in the NGN, functionalities may be distributed amongst several elements. The following clauses provide detailed steps for evolution of PSTN/ISDN to NGN.

7 Aspects to consider when evolving to NGN

For evolution of PSTN/ISDN to NGN, aspects identified in the following subclauses are to be considered.

7.1 Transport

Transport is an important part of any network. It encompasses functions related to:

- User premises equipments (e.g., terminals, PBXs, routers);
- The access network equipments (e.g., line terminating modules, remote or local concentrators, multiplexers); and
- The core network equipments (e.g., local exchanges, transmission facilities, transit and international exchanges).

All transport-related aspects, which may be affected by evolution to NGN, should be considered.

7.1.1 Leased line provisioning

Provision of leased lines is network specific.

7.2 Signalling and control

PSTN/ISDN uses signalling systems such as analogue line signalling, channel associated signalling (CAS) like signalling systems R1 [Q.310-Q.332], R2 [Q.400-Q.490], and common channel signalling (CCS), like SS7 or DSS1 [Q.931]. All these signalling systems are for the circuit switched networks. Since NGN transport is packet-based (and call and bearer are decoupled), other suitable types of signalling (e.g., BICC, SIP-I [Q.1912.5], etc.) may be required. Also, the signalling function and call control function may reside in more than one NGN element.

Since the NGN has to work with the PSTN/ISDN and other networks, interworking between NGN signalling systems and the legacy network signalling systems is required.

Signalling aspects within the next generation corporate network shall remain independent from NGN access or core network signalling.

It is further anticipated that signalling aspects for access and core networks be independent in order to provide the possibility for a step-wise approach for evolution to NGN.

7.3 Management

PSTN/ISDN management is comprised of activities from a core exchange network, access network, intelligent network and the operations support system (OSS). ITU-T Recs [M.3400] and [M.3010] provide management principles for PSTN/ISDN.

An NGN management system is comprised of three planes, namely the network management plane, the network control plane and the service management plane. Each of the three planes implements corresponding management functions to each layer in the NGN layered model. Standard interfaces between these planes need to be defined and are beyond the scope of this Recommendation.

Evolution of PSTN/ISDN management (i.e., operations, administration and management) systems requires the ability to support the transition of PSTN/ISDN through intermediate stages towards NGN. More information may be available in documents related to NGN management.

7.4 Services

PSTN/ISDN services which are traditionally provided by PSTN/ISDN exchanges may be provided by application servers (ASs) in NGN. Some services may also be implemented on the call server (CS) [Y.2271].

It is expected that some or all of the legacy services will be provided by NGN. However, there is no guarantee that all services will be provided when PSTN/ISDN is simulated.

Use of legacy terminals via adaptation to the NGN is expected in order to support existing services.

Cooperation between ASs and CSs is required in order to provide certain services.

In case of a concatenation of NGNs, it should be possible to access services from the remote NGN.

An example of PSTN/ISDN service evolution is shown in Appendix II.

7.4.1 Bearer services

While evolving from PSTN/ISDN to NGN, continuity of bearer services should be provided.

PSTN/ISDN simulation provides functionality that is similar but not identical to existing N-ISDN bearer services.

PSTN/ISDN emulation shall be capable of providing all bearer services offered by PSTN/ISDN. However, there is no requirement for NGN to support all N-ISDN bearer services identified in the ITU-T I.230-series Recommendations.

Use of NGN to connect PSTNs/ISDNs shall be transparent for all bearer services.

NGN should provide same or better QoS for PSTN/ISDN bearer services.

7.4.2 Supplementary services

While evolving from PSTN/ISDN to NGN, continuity of supplementary services should be provided to the extent practical. PSTN/ISDN emulation shall provide support for all supplementary services offered by PSTN/ISDN. PSTN/ISDN simulation provides functionality that is similar but not identical to existing PSTN/ISDN services. The NGN need not support all ISDN supplementary services identified in I.250 series of ITU-T Recommendations. NGN shall appear transparent when used to connect supplementary services between PSTNs/ISDNs.

7.5 Operation, administration and maintenance (OAM)

OAM functionality is used to verify network performance, and to reduce operational expenses by minimizing service interruptions, service degradation and operational downtimes. OAM functionality and objectives are described for legacy and IP networks in [I.610] and [Y.1710] plus several other Recommendations covering all layers and strata.

As a minimum, when performing PSTN/ISDN evolution to NGN, the ability to detect faults, defects and failures such as lost, errored or misinserted packets, should be provided. Additionally, there should be mechanisms to indicate connectivity status and provide support for performance monitoring.

Since multiple networks are involved in network evolution, it is necessary to identify and report which network or service provider is responsible for the defect so that proper action and remedy can be provided.

7.6 Naming, numbering and addressing

The NGN naming, numbering and addressing schemes, in accordance with [Y.2001], shall be able to interwork with the existing E.164 numbering scheme.

During PSTN/ISDN evolution to NGN process, it should be ensured that the sovereignty of ITU Member States, with regard to country code numbering, naming, addressing and identification plans, is fully maintained. Also, as a minimum, support should exist for Internet IP addressing schemes including E.164 Telephone uniform resource identifiers (TEL URIs), e.g., tel: +98 765 4321 and/or SIP Uniform Resource Identifiers (SIP URIs), e.g., sip:my.name@company.org.

All this should be accomplished without affecting the services provided to end-users.

7.7 Accounting, charging and billing

It is generally accepted that the introduction of NGN will result in changes to the existing "accounting, charging and billing" procedures. However, these changes will not be immediate. During the transition period, maintaining the existing procedures, to the extent practical, may be required.

Evolution from existing networks to NGN will also imply replacement of the existing sources of the accounting data generation. New business models for NGN services may increase number of business roles involved in charging.

Thus, the following accounting aspects may be affected:

a) Information content;

b) Interfaces to other systems;

c) Data format;

d) Data security, i.e., data protection, transmission security and confidentiality.

7.7.1 Considerations

The NGN shall support both offline and online charging. For evolution to NGN, the following factors shall be considered. However, this does not constitute a comprehensive list.

- Information content – the information contained in the call detail records (CDRs) shall be consistent with the information already provided in PSTN/ISDN. In particular, the following data should be provided:
  - Calling and/or called user identification;
  - Date and time of the event;
  - Type of the service or event;
  - Call duration or session duration.

  It is also necessary to provide new NGN specific information such as:
  - Bandwidth;
  - QoS;
  - Media type.
- Data sources:
  - Call server;
  - Media server;
  - Access gateway;
  - Trunking media gateway;
  - Application server.
- Data format requirements:
  - Optimal encoding complexity;
  - Convenience of data collection and record construction;
  - Optimal data size;
  - Efficient data storage.
- Interfaces to other systems:
  - For real time and bulk methods of collecting accounting data;
  - For on-line and off-line charging;
  - For other services such as advice of charge and credit limit.

Further information can be found in other ITU-T Recommendations or in [TS 122 115].

7.8 Interworking

Interworking as defined in [Y.1411] is used to express interactions between networks, between end-systems, or between parts thereof, with the aim of providing a functional entity capable of supporting an end-to-end telecommunication. PSTN/ISDN evolution to NGN should take the following into consideration:

- Ability to interwork with IMS-based or non-IMS-based networks such as other PSTN/ISDN, public IP networks (e.g., NGN, Internet);
- Ability for inter-domain, inter-area or internetwork interworking;
- Support for authentication and authorization;
- Ability to perform call admission control;
- Capability to support network performance parameters as defined in [Y.1541];
- Support for accounting, charging and billing.

NOTE – The above list is not exhaustive.

7.9 Call routing

When an NGN coexists with PSTN/ISDN, the routing scheme should allow the carriers to control where their traffic enters and leaves the NGN. This will make it possible for the carrier to optimize use of their network resources and to avoid multiple points of interworking between NGN and PSTN/ISDN along the media path.

8 Service requirements by national regulatory bodies

Where required by national/regional regulation or law, an NGN service provider shall provide:

- the basic telephone service with the same or better quality and availability as the existing PSTN/ISDN;
- the capability for accurate charging and accounting;
- capabilities to support number portability;
- capability for the user to select the carrier for local and long-distance calls;
- the availability of a directory inquiry service for PSTN/ISDN and the NGN users;
- support of emergency telecommunications as stated in clause 9;
- support for disaster recovery capabilities and procedures;
- support for all users, including the disabled. Support should provide at least the same capabilities as the existing PSTN/ISDN. NGN offers the opportunity for more advanced support, e.g., network capabilities for text to speech;
- privacy of the users and their information;
- mechanisms to support lawful interception and monitoring of various media types of telecommunications such as voice, data, video, e-mail, messaging, etc. Such a mechanism may be required of a network provider for providing access to content of telecommunication (CT) and intercept-related information (IRI) by law enforcement agencies (LEA), to satisfy the requirements of administrations and international treaties;
- interoperability between an NGN and other networks e.g., PSTN/ISDN and PLMN.

The list of required services in public telecommunications systems in each country is based on national regulation. This Recommendation does not address detailed national regulatory requirements.

9 Emergency telecommunications in NGN

It is desirable that NGN provides:

- capability to support priority mechanisms for emergency telecommunications in multimedia services (e.g., voice, data, and video). Emergency telecommunications include:
  a) individual-to-individual telecommunications;
  b) individual-to-authority telecommunications, i.e., calls to emergency service providers;
  c) authority-to-authority telecommunications. Telecommunications for disaster relief (TDR); and
  d) authority-to-individual telecommunications;
- support for calls to emergency service providers which may be free of charge for the calling user. Such calls should include information on how to enable emergency services to call back the calling user, and including at least the accurate location information about the calling user at the time of call initiation, e.g., to be provided to the emergency response centres, routing of the call to the public safety answering point (PSAP), regardless of whether the user is fixed, mobile or nomadic. Accurate location may be such information as postal address, geographic coordinates or other information like cell indicators. Both network and user location information shall be provided, if available;
- capability to ensure that calling line identification presentation (or the equivalent information in IMS) is not ruled out on a per call, per line or per identity basis for calls to the emergency call number;
- network integrity, as far as possible, in order to support critical telecommunications such as TDR support in a crisis situation.

10 Security aspects of evolution

The NGN shall provide at least the same security level as for the existing PSTN/ISDN. As PSTN/ISDN is transitioning to NGN, new concerns and threats, unknown in PSTN/ISDN, may be encountered. Therefore, additional measures may be required to guarantee at least the current security level.

Different security dimensions, depending on the access method, shall be taken into account to fulfil this demand:

- Authentication;
- Non-repudiation;
- Data confidentiality;
- Telecommunication security;
- Data integrity;
- Availability;
- Privacy.

The NGN security means may be used to secure PSTN/ISDN simulation and emulation scenarios. The complete list of requirements for NGN security is beyond the scope of this Recommendation.

Appendix I

Examples of network evolution scenarios

All the NGN evolution scenarios rely upon the separation of functionalities of transport, control, service and management aspects.

The evolution scenarios imply one or more steps, depending on the extent to which these separations are implemented.

Possible scenarios for evolution of the PSTN/ISDN are presented in the following subclauses.

I.1 Core network evolution to NGN

I.1.1 CS-based evolution to NGN

I.1.1.1 General

The CS is the core element for PSTN/ISDN emulation. It is responsible for call control, gateway control, media resource control, routing, user profile and subscriber authentication, authorization and accounting. The call server may provide PSTN/ISDN basic service and supplementary services, and may provide value-added services through service interaction with an external service control point (SCP) and/or AS in the service/application layer. A fully compliant call server implementation need only implement some of the components identified here, although it is possible to combine multiple functions in a single entity.

A call server may function in one or more of the following roles [Y.2271]:

- access call server (ACS) – to implement access gateway control and media resource control functions, thus providing PSTN/ISDN basic service and supplementary services;
- breakout call server (BCS) – to implement interworking functions to enable interconnection with PSTN/ISDN networks;
- IMS call server (ICS) – to provide interoperability between PSTN/ISDN emulation components and IP multimedia components within a single NGN domain;
- gateway call server (GCS) – to provide interoperability between different NGN domains from different service providers;
- routing call server (RCS) – to provide the routing function between call servers.

I.1.1.2 Consolidation of local and remote exchanges for evolution to NGN

In order to prepare the PSTN/ISDN for the evolution to a packet switched network (PSN), and as an initial step, some of the LEs can be removed and all their functionalities such as control, accounting, etc. transferred to those remaining LEs. The affected UAMs, PBXs, and ANs are connected to the remaining LEs. Further consolidation occurs when UAMs become RUAMs, which are connected to the remaining LEs. Figure I.1 shows this preparatory step.

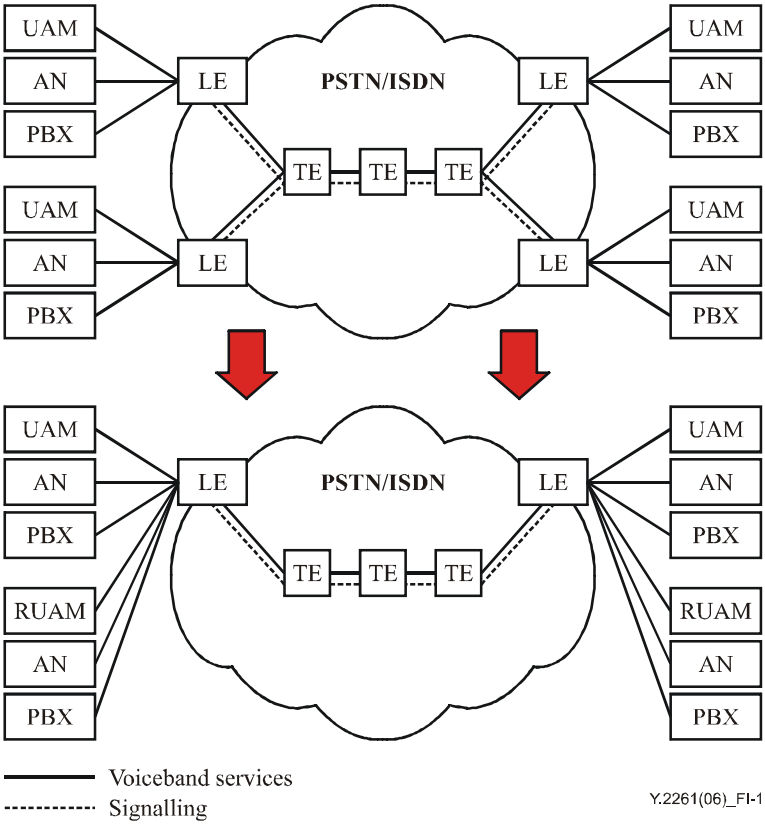


Figure I.1/Y.2261 – Preparation for evolution to NGN

I.1.1.3 Scenario 1 – PSTN/ISDN and PSN initially co-exist

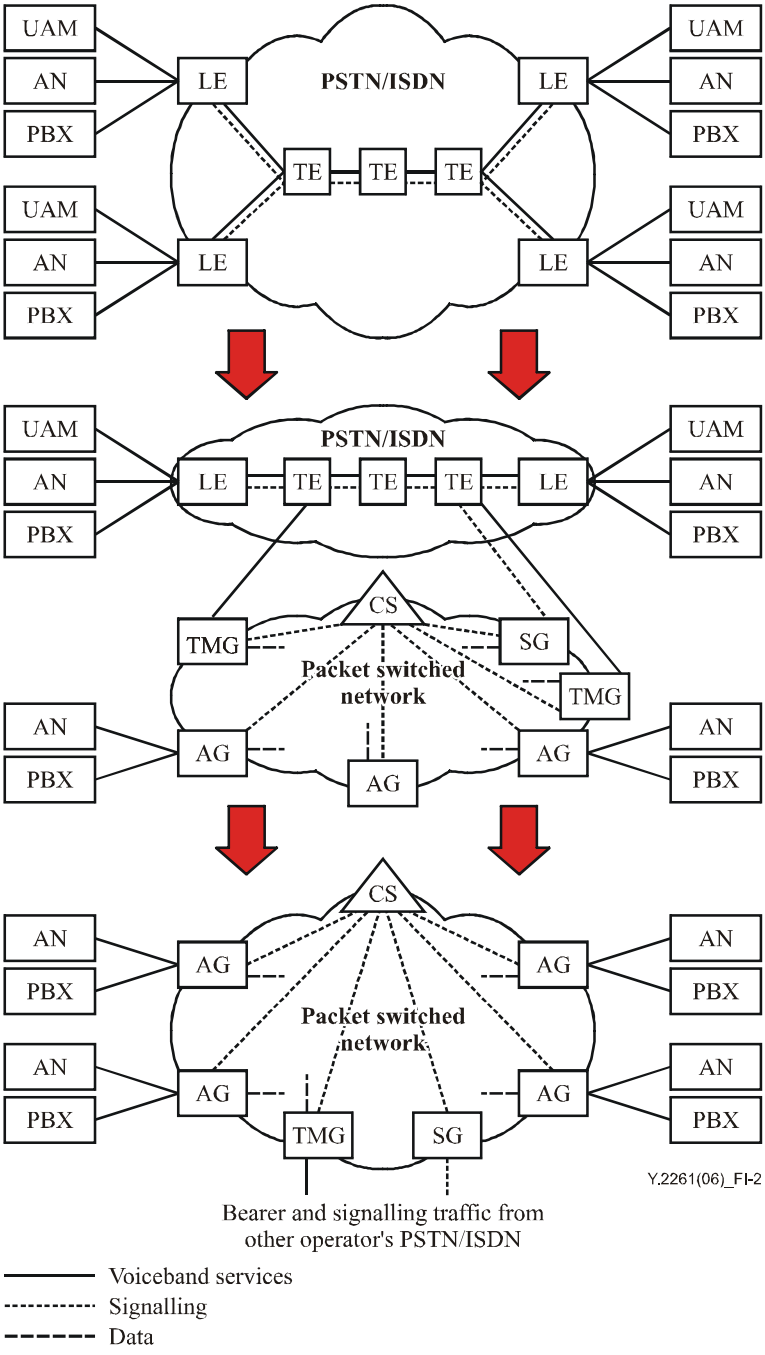
In the most likely initial approach for evolution of PSTN/ISDN to the PSN, the PSTN/ISDN will co-exist with the PSN during a transition period, as shown in Figure I.2. There are two steps in this scenario as explained below.

Step 1

In this step, some of the LEs are replaced by AGs. Functions originally provided by the removed LEs are now provided by the AGs and the CS. In addition, some of the access elements such as UAMs, RUAMs, and PBXs, which were originally connected to the removed LEs, are now directly connected to AGs. Additional AGs may also be deployed to support new subscribers that directly connect to them. The TMGs and SGs are deployed for interconnection between the PSN and the TEs of the legacy network as well as other operators' PSTNs/ISDNs. The AGs and TMGs are all controlled by the CS.

Step 2

In this step, the remaining LEs are replaced by the AGs, and the TEs are removed and their control functions are performed by CS. The TMGs and SGs are deployed for interconnection between PSN and other operators' PSTNs/ISDNs. The AGs and TMGs are all controlled by the CS.



NOTE – Data indicate packetized voiceband services.

Figure I.2/Y.2261 – Realization of scenario 1

I.1.1.4 Scenario 2 – Immediate use of PSN, initially via SGs and TMGs

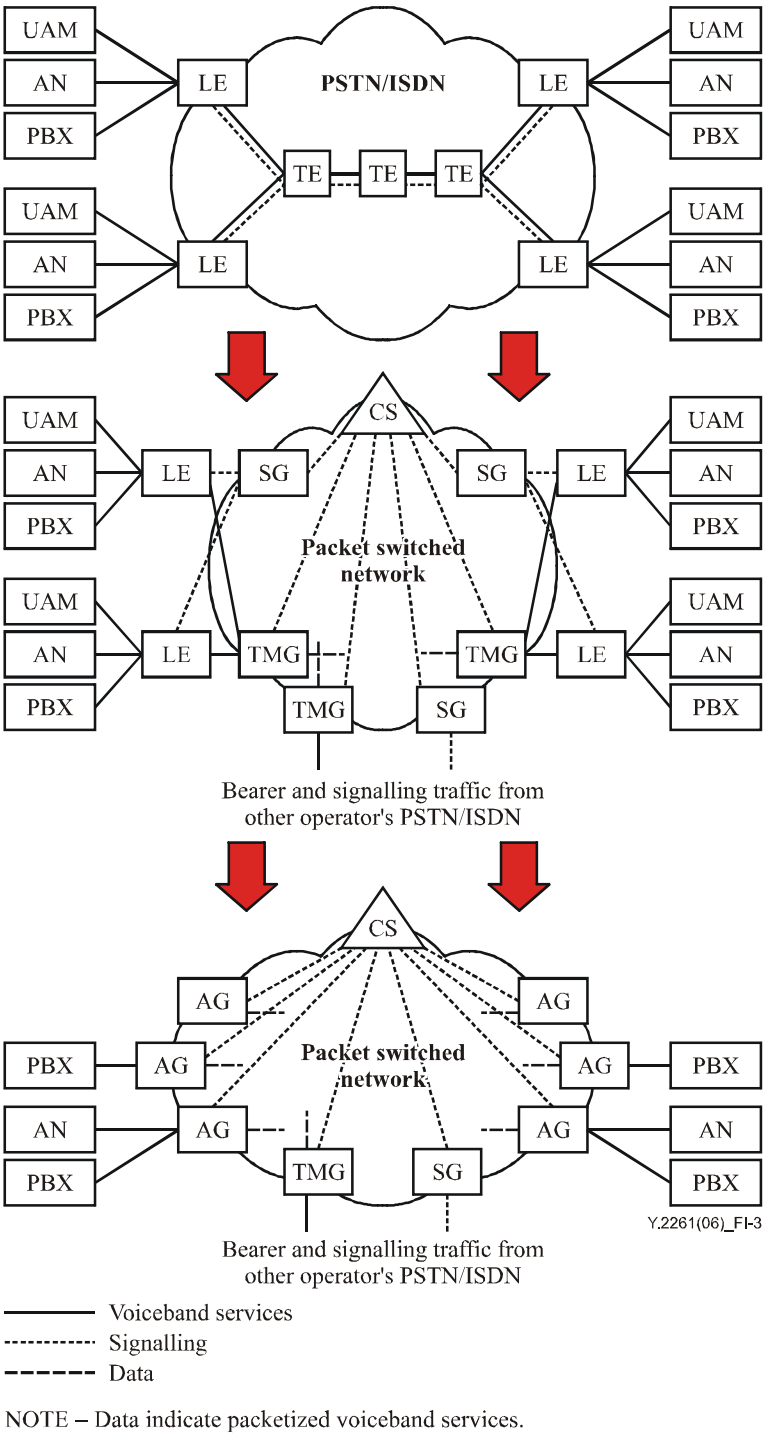
In this scenario, the PSTN/ISDN is immediately replaced by the PSN. As a first step, the LEs are connected to SGs and TMGs, while later on they are eliminated. The two steps are shown in Figure I.3 and explained below.

Step 1

In this step, PSTN/ISDN is replaced by PSN and the TE functions are performed by the TMGs and the SGs under the control of the CS. The LEs are connected to the PSN via TMGs and SGs. The TMGs and SGs are also deployed for interconnection between PSN and other operators' PSTNs/ISDNs.

Step 2

In this step, the LEs and some of the access elements such as UAMs and RUAMs are removed and their functions are provided by the AGs and CS. The PBXs are directly connected to the AGs. The ANs are either replaced by the AGs or are connected to the AGs. The TMGs and SGs are deployed for interconnection between PSN and other operators' PSTNs/ISDNs. The AGs and TMGs are all controlled by CS.

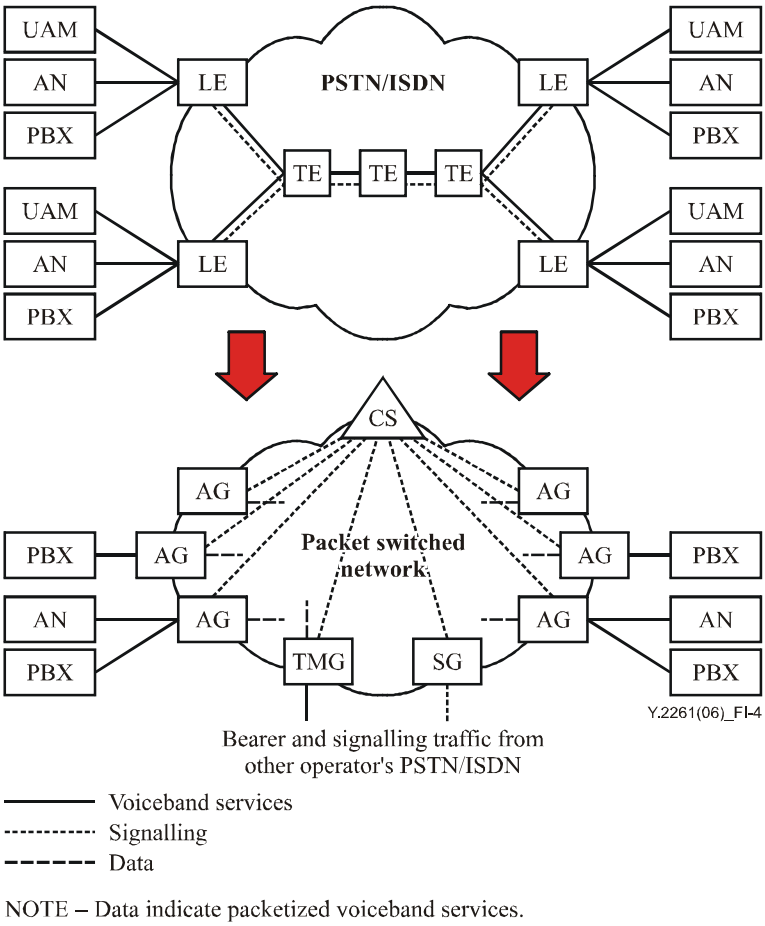


NOTE – Data indicate packetized voiceband services.

Figure I.3/Y.2261 – Realization of scenario 2

I.1.1.5 Scenario 3 – The one-step approach

In this scenario, the PSTN/ISDN is replaced with PSN in only one step as shown in Figure I.4. The LEs are replaced by AGs and their functions are divided between the AGs and the CS. Specifically, the call control and accounting functions are all transferred to the CS. All access elements such as UAMs, RUAMs, and PBXs are connected to AGs. The ANs are either replaced by the AGs or are connected to PSN through the AGs. The TMGs under the control of the CS, and the SGs, are deployed to replace the TE functions and provide interconnection between PSN and other operators' PSTNs/ISDNs.



NOTE – Data indicate packetized voiceband services.

Figure I.4/Y.2261 – Realization of scenario 3

Table I.1 provides examples of network elements to support PSTN/ISDN evolution.

Table I.1/Y.2261 – Selection of network elements to support PSTN/ISDN evolution

		ACS	BCS	ICS	GCS	RCS	AG	TMG	SG
Scenario 1	Step 1	X	X	–	–	–	X	X	X
	Step 2	X	X	X	X	X	X	X	X
Scenario 2	Step 1	–	X	X	X	X	–	X	X
	Step 2	X	X	X	X	X	X	X	X
Scenario 3	Step 1	X	X	X	X	X	X	X	X
X: may apply –: not needed									

I.1.2 IMS-based evolution to NGN

Figure I.5 shows a scenario where PSTN/ISDN evolves directly to a PSN based on the IMS core network architecture. The end-users access the network using NGN user equipment or legacy user equipment connected via an AG. The TMGs and SGs are deployed for interconnection between the NGN and other operators' PSTNs/ISDNs.

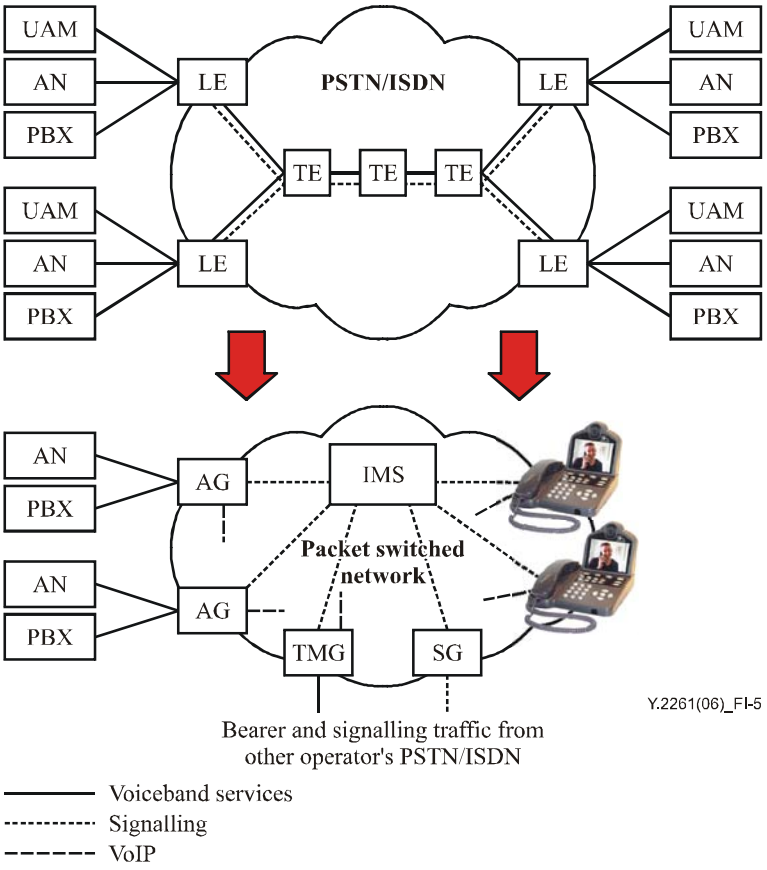


Figure I.5/Y.2261 – IMS-based PSTN/ISDN evolution to NGN

I.1.3 Concurrent CS-based and IMS-based networks

Concurrent CS-based and IMS-based implementations can occur when an existing service provider deploys a separate IMS-based network for new services and supports the remainder of the services using a CS-based approach. These two types of network implementations need to interoperate. Interoperation is possible if SIP is used, but this is beyond the scope of this Recommendation.

I.2 Access network evolution

I.2.1 Evolution of xDSL access network to NGN

Evolution of access network (AN) is shown in three possible steps.

Step 1

Traditional AN/UAM interfaces include: POTS, ISDN and V5.1/2 [G.964] and [G.965]. Such interfaces connect subscribers to the core PSTN/ISDN via LE.

Legacy voice users may also have access to broadband services for example via xDSL (see [G.995.1]). In this case, the customer-located equipment is an xDSL modem and the service provider equipment is a digital subscriber line access multiplexer (DSLAM). Since xDSL interfaces enable users to connect to the Internet, these interfaces may be utilized to connect such users to NGNs.

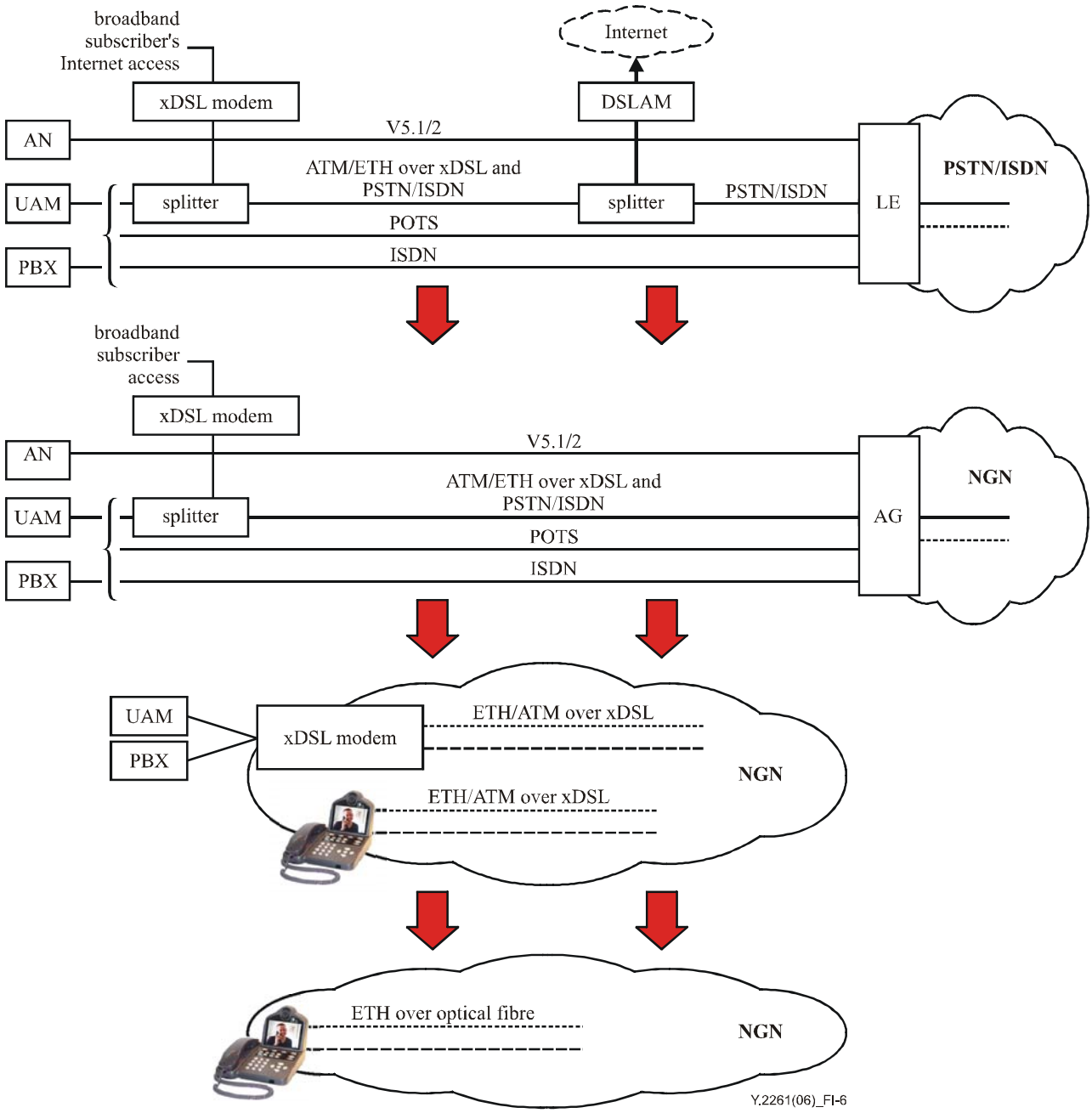
AN, for another user domain with V5.x [G.964] and [G.965] interface can be left as it is shown in Figure I.6 or it can be completely replaced by AG connected to NGN directly.

Step 2

The xDSL modem supports legacy subscribers and may enable them broadband access to NGN. An IP user may also use xDSL interface as the transport medium to an NGN. Protocol for xDSL interface may be Ethernet which enables broadband data flows and services, e.g., VoD, IPTV, VoIP and Internet.

Step 3

In this step, the legacy end systems are replaced by NGN end systems and twisted copper lines are replaced by optical fibre, either fibre-to-the-curb (FTTC) or fibre-to-the-home (FTTH) to increase transmission speed. Protocol for this transmission medium may be Ethernet.



NOTE – Data indicate packetized voiceband services.

Figure I.6/Y.2261 – Evolution of xDSL access to NGN

I.3 Signalling and control scenarios

A possible scenario for evolution of signalling in the core network consists of three steps (See Figure I.7).

Step 1

In this step, signalling functions are transferred from the TEs to the independent units creating an STP mesh network (partial or complete).

Step 2

In this step, STPs are upgraded to the SGs and are placed on the edge between PSTN/ISDN and NGN. In this case, both the legacy network and NGN co-exist with each other.

Step 3

In this step, all LEs and TEs are replaced by NGN.

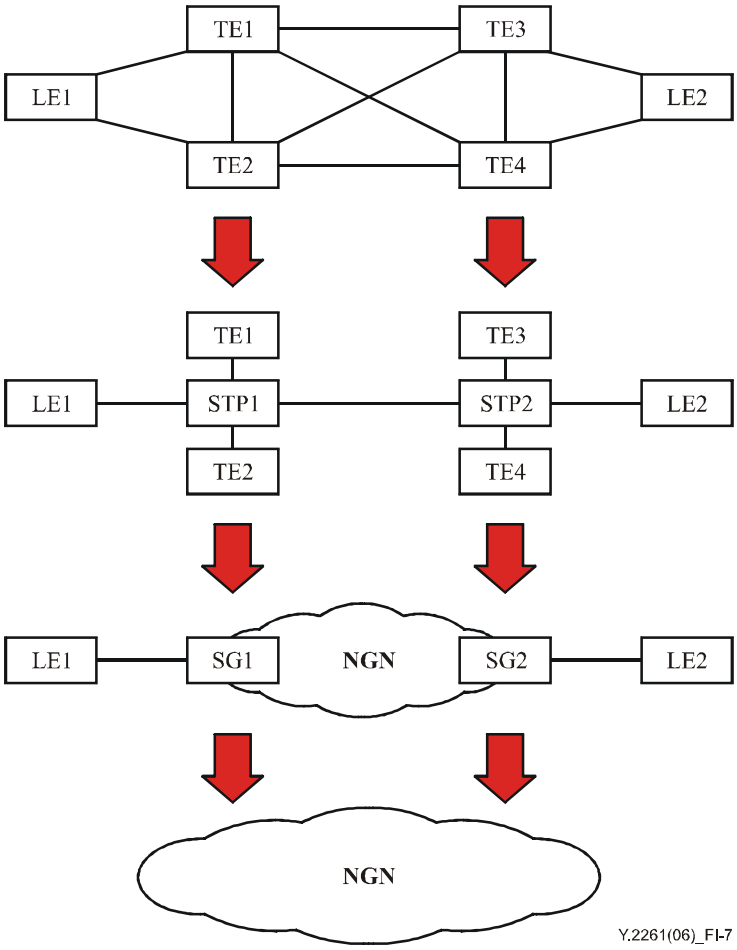


Figure I.7/Y.2261 – Realization of signalling evolution scenario

I.4 Management scenarios

Evolution of a PSTN/ISDN management system could be done in several possible ways. In one scenario, PSTN/ISDN is evolved to NGN but the PSTN/ISDN management system will be used to manage the newly evolved NGN. In another scenario, an NGN management system managing an NGN would also manage a PSTN/ISDN. This is not the extensive list of possible scenarios.

I.5 Services evolution scenarios

Possible scenarios for evolution of services in PSTN/ISDN based on IN may be as follows:

I.5.1 Scenario 1

In this scenario (see Figure I.8), existing IN services are reused in NGN by implementing SSF in the CS. Both PSTN/ISDN and NGN exist.

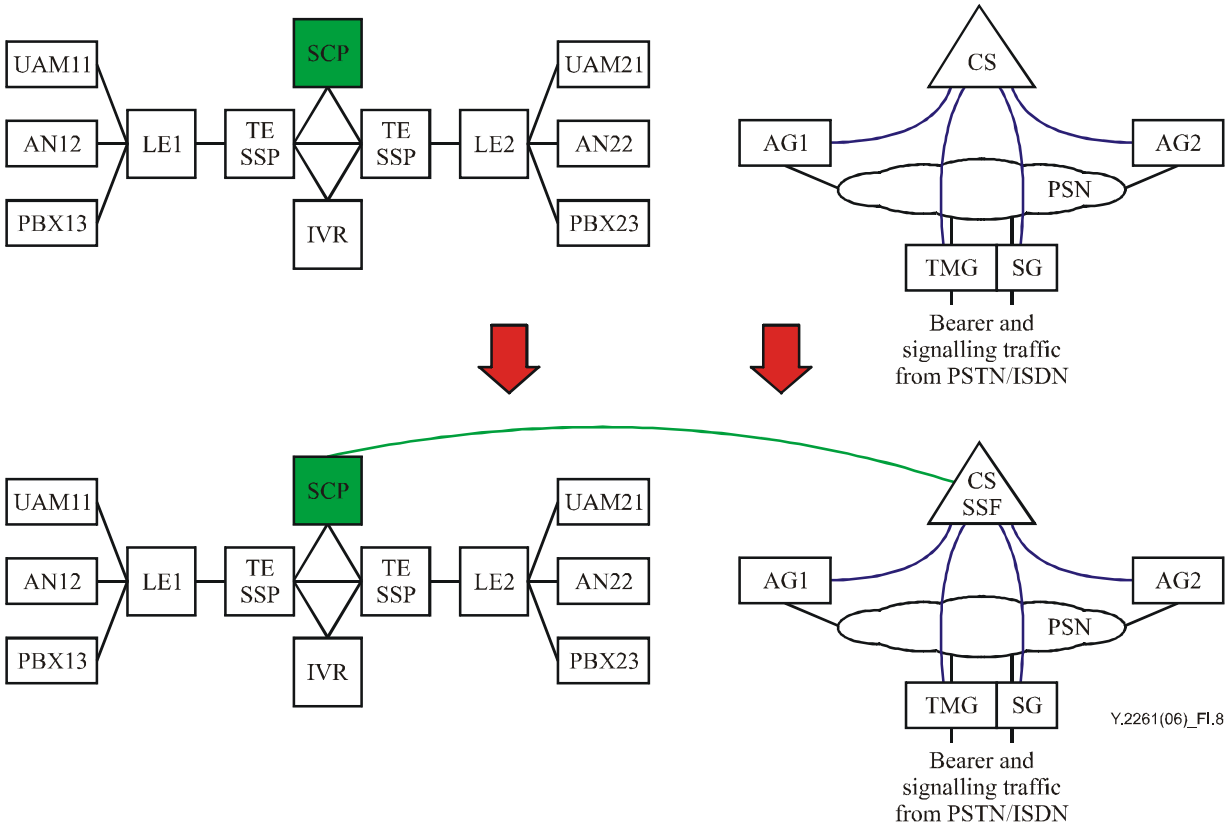


Figure I.8/Y.2261 – Realization of scenario 1

I.5.2 Scenario 2

An example of SCP integrated to the application server is shown in Figure I.9. In this networking model, the SCP is integrated to the application server. The communication sub-layer is a uniform communication layer which may provide connection between SSP, CS, SCP and the application server. The services created by the service creation environment (SCE) in the IN may be directly loaded into the SCP module of the AS. The new services developed by using open interfaces (such as Parlay APIs) may run on the application module. The SCP and the application module may be connected through a service interface sub-layer to operation and maintenance and external systems (e.g., billing centre, network management centre, accounting system).

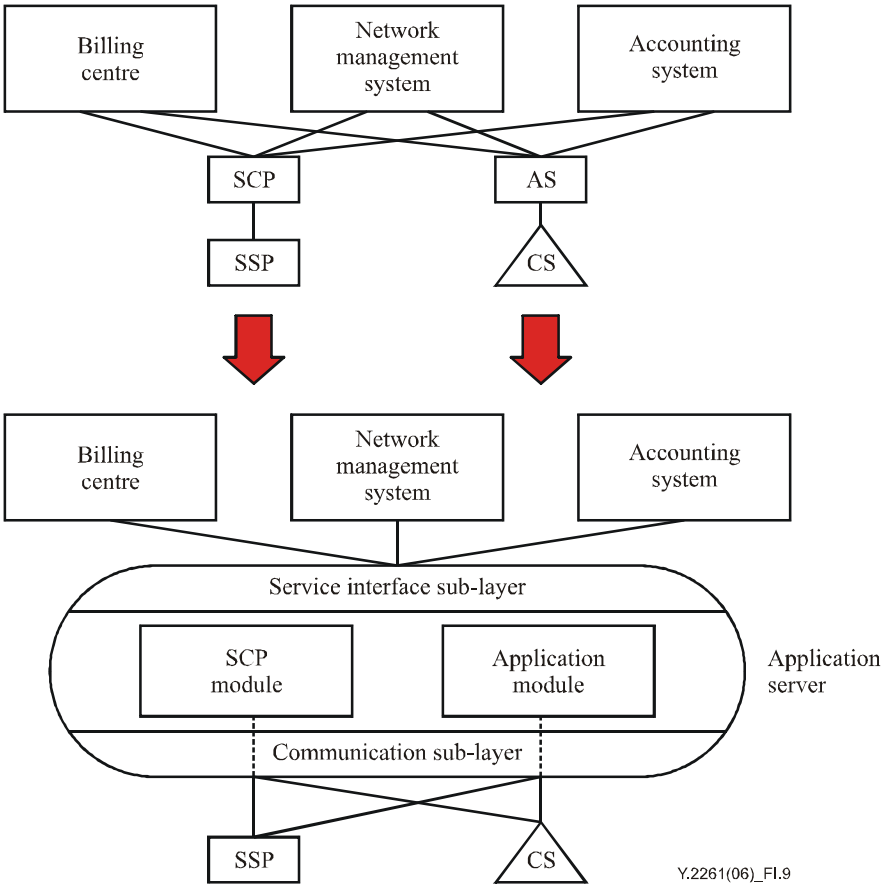


Figure I.9/Y.2261 – The SCP is integrated to the application server as a whole

I.5.3 Scenario 3

In this scenario (see Figure I.10), in order to provide some value-added services in PSTN/ISDN, IVR is used for processing dual-tone multi-frequency (DTMF) signals and announcements. In order to provide these value-added services in NGN, MS is used for processing DTMF signals and announcements with IP interface.

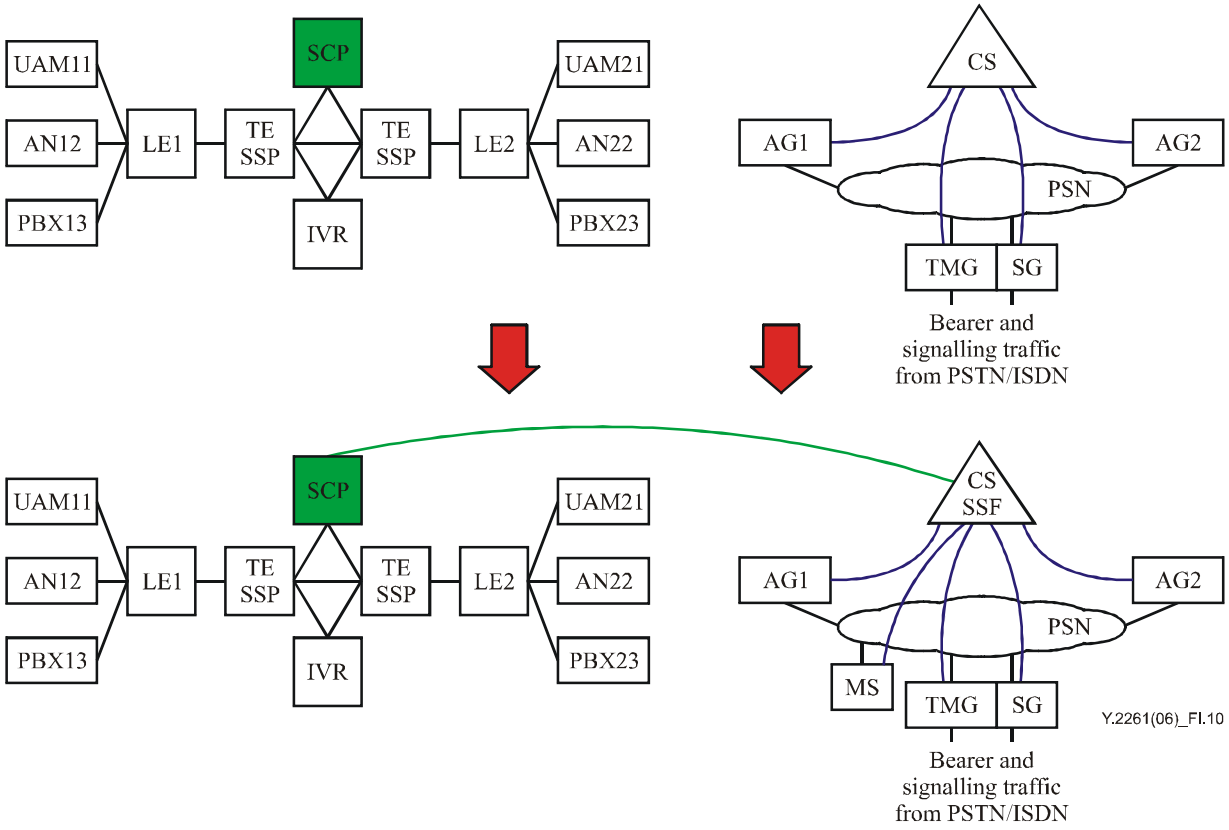


Figure I.10/Y.2261 – Realization of scenario 3

I.5.4 Scenario 4

This scenario (see Figure I.11) consists of two steps, which are executed consecutively.

Step 1

This is a step in which the traditional IN services are provided with SCP, and new value-added services are implemented in AS. During the network evolution, the service triggering function can be realized via CS or IMS. The CS or IMS connects to SCP via INAP interface, and simultaneously connects to AS via SIP interface.

Step 2

Once the evolution to the NGN is completed all the value-added services will be provided by AS.

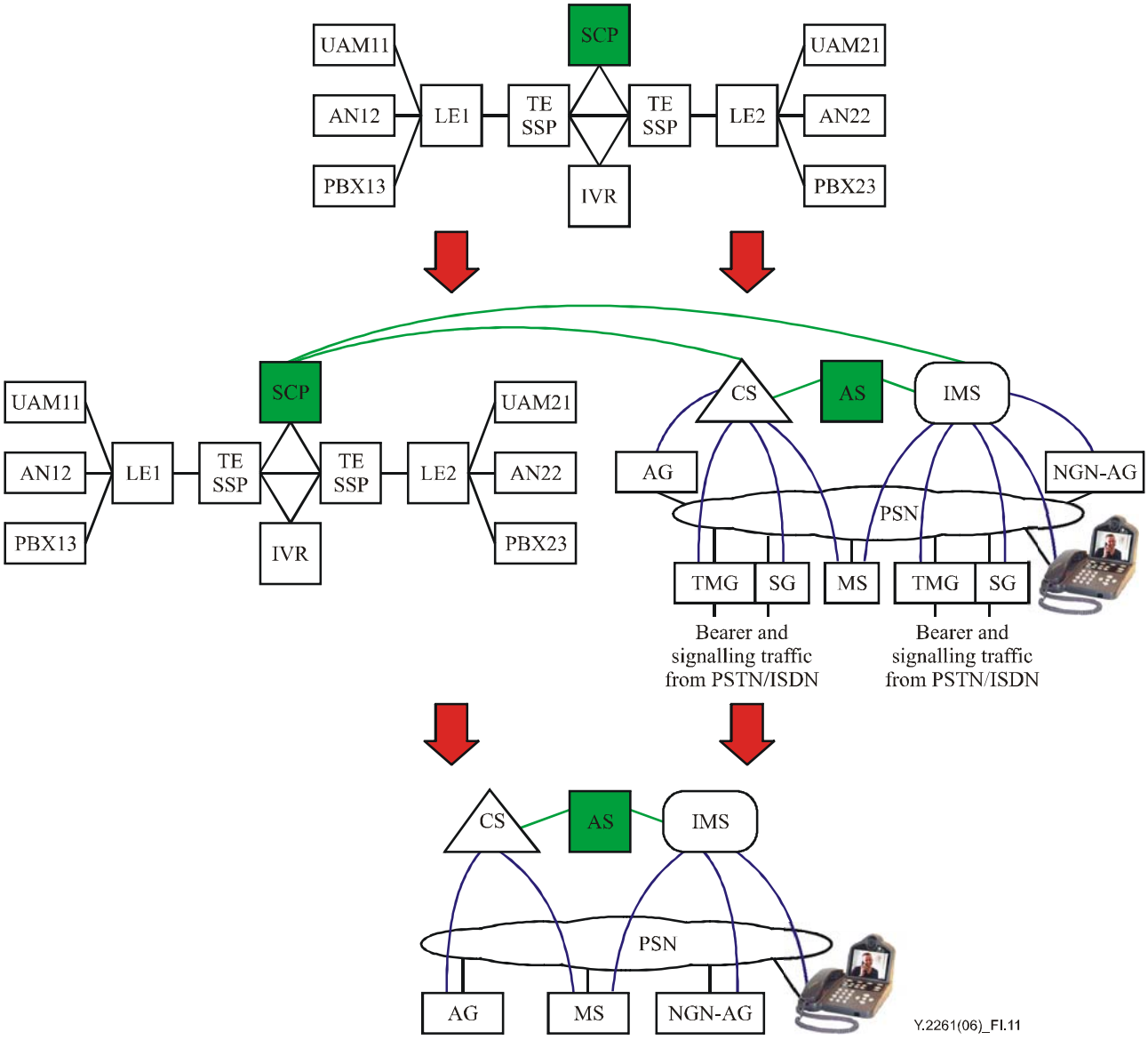


Figure I.11/Y.2261 – Realization of scenario 4

Appendix II

Examples of PSTN/ISDN service evolution

This appendix illustrates one example for the deployment of PSTN/ISDN service evolution as follows (see Figure II.1):

- Implementation of SSF function of the IN network in the control layer (using open interface INAP allows for treating the IN network elements as the elements of NGN service layer).
- Duplication/implementation of the service logic from PSTN/ISDN host in NGN service layer (application server - AS). Division of service logic from control.
- Inclusion of SCP of the IN network into NGN service layer – SSP-SCP communication through NGN IP packet network.
- Common SCE for all elements of NGN service layer – optional step.

For the separation of the service function during evolution of PSTN/ISDN, the service process in a local exchange can be transferred simply to a tandem exchange through data configuration. Only tandem exchanges are upgraded according to the above-described steps. In this way, the collection of information at the billing centre becomes simpler too, because all the services are converged at the tandem exchanges, only the information of tandem exchanges needs to be collected rather than that of all the local exchanges.

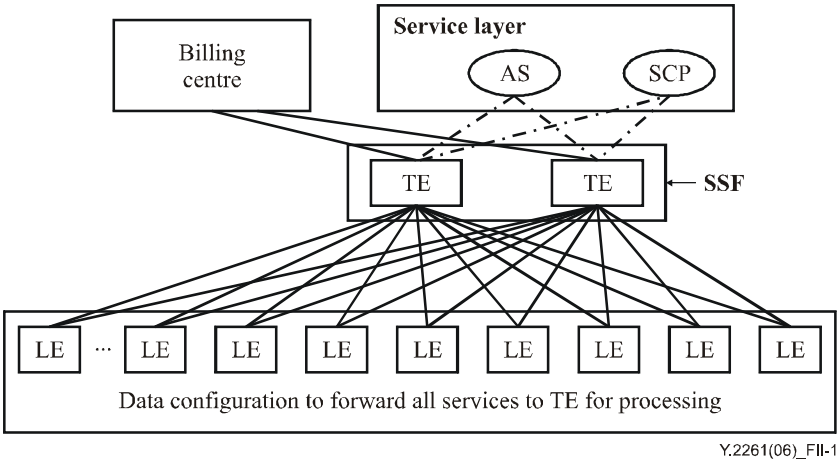


Figure II.1/Y.2261 – Service evolution from PSTN/ISDN to NGN

Appendix III

Billing system evolution scenarios

The following three scenarios (see Figure III.1) are considered when evolving to NGN. The timing or preference for selection of these scenarios is service provider dependent.

Mediation (MED) is an entity which allows transfer and processing of call detail records (CDRs) from the PSTN/ISDN to the NGN billing system, or from the NGN to the PSTN/ISDN billing system.

Scenario 1

For this scenario, an NGN billing system is considered to handle both the PSTN/ISDN and the NGN. For this case, all accounting aspects are affected.

Scenario 2

For this scenario, a new billing system is developed for the NGN, while keeping the existing PSTN/ISDN billing system. For this case, all accounting aspects are to be considered for NGN.

Scenario 3

For this scenario, a legacy billing system is considered to handle both the PSTN/ISDN and the NGN. For this case, all accounting aspects are affected.

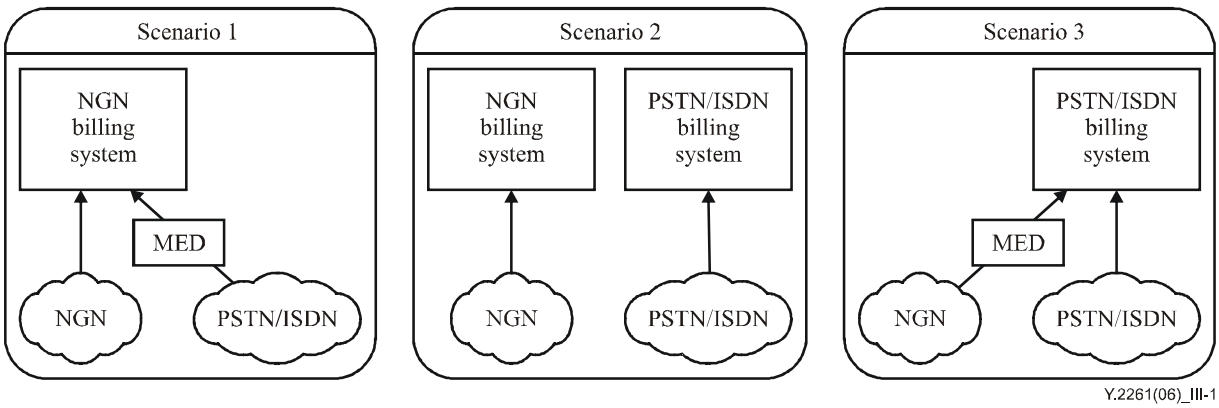


Figure III.1/Y.2261 – Billing system evolution scenarios

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[G.995.1] ITU-T Recommendation G.995.1 (2001), *Overview of digital subscriber line (DSL) Recommendations*.

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