iDA SINGAPORE

Telecommunications Standards Advisory Committee (TSAC)

Reference Specification

PSTN/ISDN Evolution to NGN

**IDA RS PSTN-ISDN Evolution
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Content

PSTN/ISDN Evolution to NGN

1   Scope

1.1   This Reference Specification defines the possible ways of evolving PSTN/ISDN to NGN. Evolution of networks to NGN is dependent on operators' choices and needs. Network operators will choose an evolution path depending on their actual resources, business plans and strategies. They may choose different technologies and timeframes.

1.2   During the transition period, the NGN is likely to have both the PSTN/ISDN emulation capabilities and the PSTN/ISDN simulation capabilities (§ 19.1 and § 19.2 of ITU-T Rec. Y.2201 [1]).

1.2.1   PSTN/ISDN emulation could provide most of the existing PSTN/ISDN service capabilities and interfaces using adaptation to an IP infrastructure, and maintain the end-user experience irrespective of the changing core network. Operators (carriers) may choose to deploy PSTN/ISDN emulation that supports only a sub-set of the PSTN/ISDN supplementary services (§ 6.1 of ITU-T Rec. Y.2262 [2]).

1.2.2   PSTN/ISDN simulation could provide PSTN/ISDN-like service capabilities that fulfil the end-users need. However, there is no guarantee that PSTN/ISDN simulation can provide all features that have been available to the PSTN/ISDN user. Simulated PSTN/ISDN may provide additional new features and capabilities that have not been available to the users of PSTN/ISDN (§ 6.1 of ITU-T Rec. Y.2262 [2]).

1.2.3   In line with the objectives of NGN, the evolution of PSTN/ISDN to NGN should provide extensible platform and architecture that allow services to be provided as and when available (§ 4 of ITU-T Rec. Y.sup7 [3]). PSTN/ISDN emulation and simulation services to be provided should include capabilities for supporting aspects of public interest, as defined in § 20 of ITU-T Rec. Y.2201 [1] and § 5.5 of ITU-T Rec. Y.sup7 [3].

1.3   Section 2 of this Specification defines the aspects that need be considered when evolving the transport, management, signalling and control parts of PSTN/ISDN to NGN (ITU-T Rec. Y.2261 [4]).

1.4   Section 3 of this Specification defines the functional architecture, inter-working with other components and reference points requirements of the PSTN/ISDN emulation component, including the Call Server based (CS-based) and IP Multimedia Server based (IMS-based) approaches (ITU-T Rec. Y.2031 [5]).

1.5   Section 4 of this Specification outlines the service and network capability requirements for the Call Server based PSTN/ISDN emulation component, and the list of network elements used in conjunction with the CS-based PSTN/ISDN emulation component (ITU-T Rec. Y.2271 [6]).

2   PSTN/ISDN Evolution to NGN

2.1   General PSTN/ISDN Functionalities

PSTN/ISDN comprises the following functionalities:

a)   Transport (access plus core): user access module (UAM), remote user access module (RUAM), access network (AN) via V5.1/2 [ITU-T Rec. G.964] and [ITU-T Rec. G.965] interface connected to the core switches and the core switches themselves
b)   Control and signalling: exchange hosts
c)   Management: management of exchanges
d)   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.

2.2   Aspects to consider for evolving PSTN/ISDN to NGN

2.2.1   Transport

PSTN/ISDN transport aspects affected in the NGN evolution include:

a)   User premises equipment (e.g. terminals, PABX, routers)
b)   Access network equipment (e.g. line terminating modules, remote or local concentrators, multiplexers)
c)   Core network equipment (e.g. local exchanges, transmission facilities, transit and international exchanges)
d)   Leased lines (provision is network specific)

2.2.2   Signalling and Control

2.2.2.1 PSTN/ISDN uses signalling systems such as R2 and SS7 for circuit switched networks. Since NGN is IP-based, other types of signalling (e.g. SIP-I, ITU-T Rec. Q.1912.5) are required. Signalling function and call control function may reside in more than one NGN element.

2.2.2.2 Inter-working between NGN signalling systems and legacy network signalling systems is necessary.

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

2.2.2.4 Signalling aspects for access and core networks shall be independent for the incremental approach to the NGN evolution.

2.2.3   Management

2.2.3.1 The PSTN/ISDN management system includes activities in the core and access networks (exchange network management, access network management, intelligent network management and Operation Support System). ITU-T Rec. M.3400 and M.3010 provide management principles for the PSTN/ISDN.

2.2.3.2 In contrast, the NGN management system comprises three planes, namely the network management plane, network control plane and service management plane. Each of these three planes implements corresponding management functions to each layer in the NGN layered model. Standard interfaces between these planes will be defined.

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

2.2.4   Services

2.2.4.1 PSTN/ISDN services traditionally provided by PSTN/ISDN exchanges are provided by Application Servers (AS) in NGN. Some may be implemented in the Call Server (CS).

a)   It is expected that some or all of the legacy services be provided by NGN.
b)   Use of legacy terminals via adaptation to the NGN is expected.
c)   Cooperation between AS and CS is required provide certain services
d)   In case of a concatenated NGN, it should be possible to access services from the remote NGN.

2.2.4.2 An example of PSTN/ISDN service evolution is shown in Appendix I, ITU-T Rec. Y.2261.

2.2.5   Operation, Administration and Maintenance (OAM)

2.2.5.1 OAM functionality verifies network performance and reduces operational expenses by minimizing service interruptions, degradation and operational downtimes. OAM functionality and objectives are described for legacy and IP networks in ITU-T Rec. I.610 and Y.1710 plus several others, covering all layers.

2.2.5.2 When evolving the PSTN/ISDN to NGN, the ability of detecting faults, defects and failures such as lost, faulty packets should be provided. Additionally there should be mechanisms to indicate connectivity status and provide support for performance monitoring.

2.2.5.3 Since multiple networks are involved in the 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.

2.2.6   Naming, Numbering and Addressing

2.2.6.1 NGN naming, numbering and addressing schemes shall be able to inter-work with existing E.164 numbering scheme. The sovereignty of ITU Member States with regard to country code numbering, naming, addressing and identification plans shall be fully maintained. Also, as a minimum, support should exist for Internet IP addressing schemes including E.164 Telephone uniform resource identifiers (TEL URIs) and/or SIP Uniform Resource Identifiers (SIP URIs). All these should be accomplished without affecting the services provided to end-users

2.2.7   Accounting, Charging and Billing

2.2.7.1 Introduction of NGN will result in changes to the existing accounting, charging and billing procedures. However, changes will not be immediate. During the transition period, existing procedures should be maintained to the extent practicable.

2.2.7.2 Evolution to NGN will imply replacement of existing sources of accounting data generation. 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)

2.2.7.3 The NGN shall support both offline and online charging. Information content shall be consistent with information already provided in PSTN/ISDN. Factors such as information content, data sources, data format requirements and interfaces to other systems shall be considered for evolution to NGN. Specific requirements are addressed in Y.NGN-account and ETSI TS 122 115.

2.2.8   Inter-working

Inter-working as defined in ITU-T Rec. Y.1411 aims to provide a functional entity capable of supporting end-to-end telecommunications. PSTN evolution to NGN should take the following into consideration (not an exhaustive list):

   a)   Ability to inter-work with non-IMS based networks such as PSTN/ISDN, public land mobile network (PLMN) and public IP networks
   b)   Ability for inter-domain or inter-network inter-working
   c)   Support for authentication and authorization
   d)   Ability to perform call admission control
   e)   Capability to support network performance parameters as defined in ITU-T Rec. Y.1541
   f)   Support for accounting, charging and billing

2.2.9   Call Routing

When NGN coexists with PSTN/ISDN, routing scheme should allow the operators to control where their traffic enters and leave the NGN for optimisation of network resources.

2.3   Service Requirements by National Regulatory Bodies

Where required by national regulation, the NGN shall provide:

   a)   Basic telephone service with the same or better quality and availability as the existing PSTN/ISDN
   b)   Capability for accurate charging and accounting

    c)   Directory inquiry service for PSTN/ISDN and NGN services
    d)   Public interest aspects (for both the PSTN/ISDN simulation and the PSTN/ISDN replacement support)
    e)   Support for disaster recovery capabilities and procedures
    f)   Interoperability between NGN and other wire-line and wireless telecommunication networks

2.4 Emergency Telecommunications in NGN

NGN should support:

    a)   Priority mechanisms for emergency communications in multimedia services (voice, data and video)
    b)   Calls to emergency service provider, including location information of calling user at the time of call initiation regardless of whether user is fixed or mobile
    c)   Calling line identification (or the equivalent information in IMS) for calls to emergency call numbers
    d)   Network integrity for critical communications in a crisis situation

2.5 Security Aspects of Evolution

2.5.1   NGN shall provide the same security level as in the existing PSTN/ISDN. Security dimensions according to access methods shall take into account:

    a)   Authentication
    b)   Non-repudiation
    c)   Data confidentiality
    d)   Telecommunication security
    e)   Data integrity
    f)   Availability
    g)   Privacy

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

3 PSTN/ISDN Emulation in NGN

PSTN/ISDN emulation is one of the service components of the NGN, inter-working with existing network and other service components (see Figure 1). It provides the emulation of PSTN/ISDN services for the legacy terminals connected via residential gateways and access gateways to the NGN. There are two solutions for the PSTN/ISDN emulation service component, the Call Server based (CS-based) emulation and IP Multimedia Server based (IMS-based) emulation, to be deployed based on network situations.
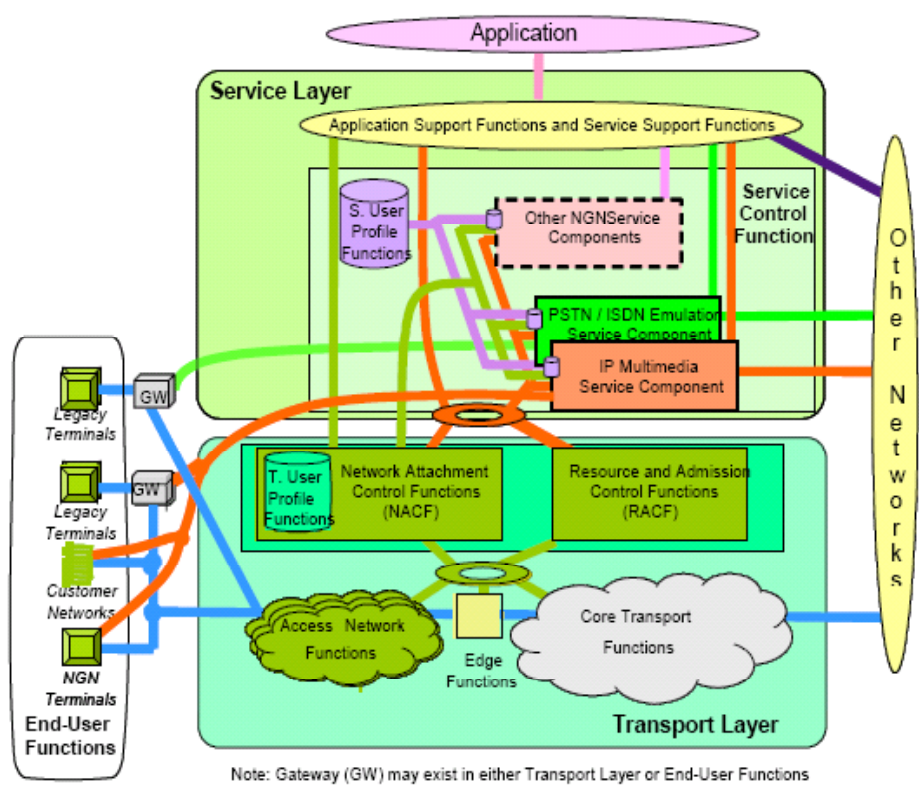

Figure 1: PSTN/ISDN Emulation in NGN (Figure 5.1/ITU-T Rec. Y.2031)

3.1 CS-based PSTN/ISDN Emulation Functional Architecture

3.1.1 The functional architecture of the CS-based PSTN/ISDN emulation is given in Figure 6.1/Y.2031. It provides a detailed view of the functional entities and reference points that make up this architecture and shows their relationship with other service components of NGN architecture. The functions outside of the PSTN/ISDN emulation component may be identical to the same functional entities described in ITU-T Rec. Y.2012.

3.1.2 Functional entities of the CS-based PSTN/ISDN emulation service (CS-PES) component as defined in § 6.1/ITU-T Rec. Y.2031:

    a) Call control function (CCF)
    b) Access gateway control function (AGCF)
    c) Media resource control function (MRCF)
    d) Media gateway control function (MGCF)
    e) Routing function (RF)
    f) Service provider function (SPF)
    g) Service switching function (SSF)
    h) Signalling inter-working function (SIF)

3.1.3 The CS-PES component should support the PSTN/ISDN supplementary services, intelligent network services, and the AS-FE provided services. The service architecture for the CS-PES component is

based on the service architecture of the ITU-T Rec. Y.2012 (refer to § 6.2 and Figure 6.2/ITU-T Rec. Y.2031).

3.1.4   Reference points requirements are defined in § 6.3/ITU-T Rec. Y.2031, describing the reference points between functions of the CS-PES component and a number of NGN functional entities which together constitute the CS-PES functional architecture.

3.1.5   Relationship between functional entities in CS-PES functional architecture and NGN architecture is defined in § 6.4/ITU-T Rec. Y.2031.

3.1.6   Inter-working with other PSTN/ISDN emulation service components and IP multimedia service components are defined in § 6.5/ITU-T Rec. Y.2031.

3.2   IMS-based PSTN/ISDN Emulation Functional Architecture

3.2.1   The functional architecture of the IMS-based PSTN/ISDN emulation is given in Figure 7.1/Y.2031.

3.2.2   Functional entities of the IMS-based PSTN/ISDN emulation service (IMS-PES) component as defined in § 7.2/ITU-T Rec. Y.2031:

   a)   Access gateway control function (AGCF)
   b)   Multimedia resource function controller (MRFC)
   c)   Media gateway control function (MGCF)
   d)   Proxy call session control function (P-CSCF)
   e)   Service call session control function (S-CSCF)
   f)   Interrogating call session control function (I-CSCF)
   g)   Breakout gateway control function (BGCF)

3.2.3   Reference points that are internal to the IMS-PES component are defined in § 7.3/ITU-T Rec. Y.2031.

3.2.4   The service architecture for the IMS-PES component is defined in § 7.4 and Figure 7.3/ITU-T Rec. Y.2031. It is similar to the IMS service architecture specified in the ITU-T Rec. Y.2012 and Y.2021.

3.2.5   Reference points with functional entities in the transport layer are defined in § 7.5/ITU-T Rec. Y.2031.

3.2.6   Interconnection with PSTN/ISDN and other IP-based service components (including other PES components) are defined in § 7.6/ITU-T Rec. Y.2031.

3.2.7   Reference point with the network attachment control function (NACF) is defined in § 7.7/ITU-T Rec. Y.2031.

3.2.8   Reference point with the resource and admission control function (RACF) is defined in § 7.8/ITU-T Rec. Y.2031.

3.2.9   Mode of Operation (§ 7.9/ITU-T Rec. Y.2031)

   a) Emulating PSTN/ISDN services using the IMS-PES architecture assumes that the logic of the services to be emulated resides in one or more application servers rather than in the AGCF or in gateways. Emulating most PSTN supplementary services requires that at least one application server be inserted in the SIP signalling path. For certain call configuration, this requires that information sent/received by some of these application servers facilitates legacy services.

   b) The logic embedded in the AGCF is either inter-working logic (e.g. the AGCF has to know how to convert the incoming session control request into a presentation message of the protocol for display services over analogue lines) or service independent feature logic (e.g. on receipt of an off-hook or flash-hook event from a media gateway, the AGCF shall autonomously request the media gateway to play a dial tone).

3.2.9.1 Service provisioning in the SUP-FE/SAA-FE and the AGCF are described in § 7.9.2/ITU-T Rec. Y.2031.

3.2.9.2 Registration and deregistration procedures are described in § 7.9.3/ITU-T Rec. Y.2031.

3.2.10 Mapping between functional entities in IMS-PES functional architecture and NGN architecture is provided in § 7.10/ITU-T Rec. Y.2031.

4   Capabilities and Network Elements of the CS-PES Component

4.1   Service Capabilities

The CS-PES component should support:

a)   PSTN/ISDN teleservices and supplementary services as per ITU-T Rec. I.240 and I.250 series
b)   Capabilities provided by the application server (AS)
c)   Capabilities provided by traditional IN
d)   Public interest services

4.2   Network Capabilities

Network capabilities for a CS-PES component as described in § 7.2/ITU-T Rec. Y.2271 are listed as follows:

a)   Numbering, naming and addressing
b)   Call routing
c)   Accounting, charging and billing
d)   User profile management
e)   Access network types
f)   Capabilities to support various types of user equipment
g)   Identification, authentication and authorization
h)   Media resource management
i)   Quality of service (QoS)
j)   Security
k)   Open service environment
l)   Emergency telecommunications
m)   Inter-working

4.3   Network Elements

Network elements used in conjunction with the CS-PES component as described in § 8/ITU-T Rec. Y.2271 are listed as follows:

a)   Application Server
b)   Application Server Gateway
c)   User Profile Server
d)   Call server (Access Call Server, Breakout Call Server, IMS Call Server, Gateway Call Server and Routing Call Server)
e)   Gateways (Access Gateway, Trunking Media Gateway, Signalling Gateway, Access Border Gateway and Interconnection Gateway
f)   Media Server

5   References

Requirements given in this Specification are based on the following reference documents:

[1]   ITU-T Rec. Y.2201 (09/2009)   Requirements and capabilities for ITU-T NGN

[2]   ITU-T Rec. Y.2262 (12/2006)   PSTN/ISDN emulation and simulation

[3]   ITU-T Rec. Y.sup7 (09/2008)   ITU-T Y.2000-series – Supplement on NGN release 2 scope

[4]   ITU-T Rec. Y.2261 (09/2006)   PSTN/ISDN evolution to NGN

[5]   ITU-T Rec. Y.2031 (09/2006)   PSTN/ISDN emulation architecture

[6]   ITU-T Rec. Y.2271 (09/2006)   Call server based PSTN/ISDN emulation

Annex A

Addendum/Corrigendum

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Changes to IDA RS PSTN/ISDN Evolution Issue 1, Feb 2007			
Page	**RS Ref**	**Items Changed**	**Date of Issue**
3 and 6	§ 1.2 and § 2.3	The Specification has been updated with references which define and differentiate the services capabilities of the PSTN/ISDN emulation, and the PSTN/ISDN simulation (§ 19.1 and § 19.2 of ITU-T Rec. Y.2201 [1], § 6.1 of ITU-T Rec. Y.2262 [2], and § 4 and § 5.5 of ITU-T Rec. Y.sup7 [3]). There are no changes to the requirements set out previously.	23 Jan 2014