ITU-APT Workshop on NGN Planning
16 – 17 March 2007, Bangkok, Thailand

ITU-D STUDY GROUP 2 QUESTION 19-1/2

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Question 19-1/2: Strategy for migration from existing to next-generation networks (NGN) for developing countries

Statement of the situation

Most of the existing switching networks, especially in developing countries, are circuit-switched based.

Convergence of voice, data and video requires packet-switched networks.

Lack of resources in developing countries could lead to a delay in implementing packet-switched networks.

ITU-D can play an important role in assisting Member States and Sector Members in developing countries with the smooth evolution from existing networks to next-generation networks (NGN), taking into consideration that the standardization of these networks is embedded as a priority in the strategic plan of ITU-T.

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Draft Work Program for Question 19-1/2

1. Introduction
2. Identification of active collaborators
3. Working Plan
4. Working Methods
5. Contributions

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Introduction

- Study Group 1 - Regulatory issues
- Study Group 2 - Technical issues
- Working procedures in accordance with Resolutions 1and 2 of WTDC-06 to be applied by Study Groups
- The work on an assigned Question should be organized and follow a work programme so that the expected results could be satisfactorily reached.

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Identification of Active Collaborators

- An important contribution for the work to be made on this Question is expected to come from a group of collaborators (Rapporteur's Group).
- All interested parties are invited to join the Rapporteur's Group so that the work on this question can satisfactorily progress and comprehensively cover the scope of Q19 1/2.

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Work Plan – List of Tasks to Be Completed

- The issues proposed for study under Q19 1/2;

A) trends of telecommunication networks migration towards NGN.

B) examination of NGN technologies (network management, transport networks, access networks, interworking with existing networks, etc)

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Work Plan – List of Tasks to Be Completed

C) methodologies for planning, with taking into account the behaviour of different existing networks.

D) Migration solutions to NGN

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Work Plan – List of Tasks to Be Completed

During the work period, the expected outputs for Question 19-1/2 are:

i. Yearly progress report on NGN development

ii. A report of methodologies for planning NGN (multidimension planning process, services demand forecasting methods, traffic forecasting models, and structure and dimensioning optimization methods.

iii. A set of guidelines for migration from existing networks to NGN

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Results Anticipated Including Titles of Output Documents and Their Target Dates

The Results and the Target Dates Proposed for the 2006-2010 Period Are Proposed to Be:

DATE	ACTIVITY/EXPECTED OUTPUT	PERSON RESPONSIBLE
September 2007 (SG2 meeting)	a), b), c) and d) first yearly report focusing on case studies and best practices from developing countries as well as developed countries on migration towards NGN	Rappoorteur's Group

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Results Anticipated Including Titles of Output Documents and Their Target Dates (Cont'd)

DATE	ACTIVITY/EXPECTED OUTPUT	PERSON RESPONSIBLE
Sep-08	a), b), c) and d) second yearly report with draft guidelines for developing countries on migration towards NGN	Rappoorteur's Group
Sep-09	a), b), c) and d) Draft final report with guidelines for developing countries on migration towards NGN	Rappoorteur's Group
Nov-09	a), b), c) and d) Finalizationof Report with guidelines for developing countries on migration towards NGN (1)	Rappoorteur's Group

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Liaison Required With Other Groups

Question 19-1/2 will liaise closely with related BDT programmes, ITU-T in particular SG13 and ITU-R SGs involved in NGN studies, ITU-D Q.10-2/2, Q.18-1/2, Q.20-2/2 and Q.6-2/1, Q.7-2/1, Q.19-1/1.

Virtual or face-to-face meetings will be held at a minimum of once per year in order to accomplish the work plan

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Working Methods

- The Rapporteur's Group will make use of all pst efforts done in the ITU-D and Q.19/2
- Concerning procedures to be followed, the group work is conducted by using the electronic means available to the extent practicable, respecting the target deadlines presented above at the best.

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Working Methods

- Concerning the expected outputs, status reports will be presented each year to the Study Group 2 Management Team as well as to the Study Group 2 PlenaryMeeting.
- The final Report will be concluded and presented during the September 2009 Study Group Plenary Meeting.

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Contributions

- Contributions in response to the work of Question 19-1/2 are invited.
- Contributions should be sent to the Rapporteur's Group.
- Those interested should get in touch with the following; (to have their names included in the distribution list of the Rapporteur's Group) riccardo.passerini@itu.int

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Conclusion

- Network providers and service providers need to contribute to the development of process regarding convergence of networks (termed as NGN) in order to fully understand and be part of the industry's evolution.
- The time to start is now.

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Interactions between NGNs and non-NGN environments

An important aspect of providing seamless operation is the ability of interworking between NGNs, and between NGNs and other networks, such as PSTN.

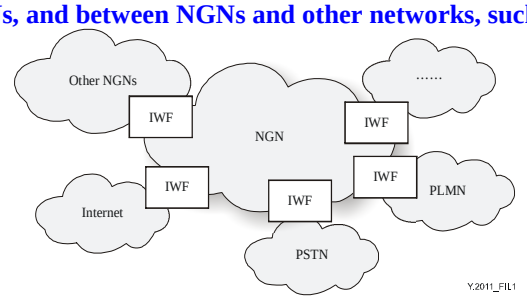

Figure II.1/Y.2011 – Interworking of NGN with other NGNs and legacy networks

It is envisaged that NGN will interwork with other networks to ensure:

- **end-to-end communication capabilities for users of such networks as PSTN are preserved;**
- **content delivery capabilities for users of Internet, TV networks, etc.;**
- **step-by-step (transitional) deployment of NGN;**
- **inheritance of rich services from legacy networks.**

Definitions

:

3.1 **Access Gateway (AG):** A unit that provides subscribers with various service access (e.g. PSTN, ISDN, V5.x, xDSL, LAN etc.) and connects them to the packet node (IP or ATM) of an NGN.

3.2 **Access Network (AN):** See Recommendation G.964[x].

3.3 **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.

3.4 **Application Server (AS)**: A unit that supports service execution, e.g. to control Call Servers and NGN special resources (e.g. media server, message server).

3.5 **Call server (CS)**: A unit which controls set-up, maintenance, modification and release of a call.

3.6 **Customer network:** A telecommunications network belonging to the customer and located in the customer premise(s). The customer network is connected to the user side of an access network

3.7 **Evolution to NGN:** A process in which parts of the existing networks are replaced or upgraded to the corresponding NGN components providing similar or better functionality, while maintaining the services provided by the original network. In addition,evolution to NGN will provide extra capabilities to the existing networks.

3.8 **Gateway:** A unit that interconnects different networks and performs the necessary translation between the protocols used in these networks.

3.9 **Next Generation Network (NGN):** See Recommendation Y.2001 [x].

3.10 **Node:** A network element (e.g. switch, router, exchange) providing switching and/or routing capabilities.

3.11 **PBX:** See Recommendation G.100

3.12 **Public Switched Telephone Network (PSTN):** See Recommendation G.100 [x].

3.13 **Signalling Gateway (SG):** A unit that provides signalling conversion between the NGN and the other networks (e.g. STP in SS7)

3.14 **Telecommunication service:** See Recommendation F.700 (xx).

3.15 **Transit Gateway (TG)**: A unit that provides an interface between the packet nodes of the NGN and the circuit switched node of the PSTN for bearer traffic. The TG provides any needed conversion to the bearer traffic.

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Evolution principles to NGN

Evolution to NGN should allow continuation of the existing network capabilities and in addition facilitate implementation of new capabilities. Evolution to NGN should respect the integrity of services provided by the existing networks and should facilitate introduction of new services.

Considering that provision of NGN is an evolutionary process it is necessary to define a step-by-step approach leading to the NGN as a target network.

This approach should consider the following objectives:

- **separation of transport, control, management and service functions.**
- **reduction of cost for the network infrastructure and its maintenance**
- **maximum reuse of the existing resources**
- **achieving comparable QoS level as provided in the existing network**
- **optimum use of the new technologies**
- **rapid implementation of new services and technologies enabling introduction of new applications**
- **provision of mechanisms enabling user's full utilisation of the applications and network resources.**

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Evolution of PSTN/ISDN to NGN

NGN (Next Generation Network) is believed to provide new opportunities for and capabilities to the network and service providers. Considering that existing networks have different life span and vast amount of capital has been spent on them, complete replacement of their components is not considered to be either advisable or possible. So, a phased approach should be considered for evolution of existing networks to NGN.

PSTN/ISDN (Public Switched Telephone Network/Integrated Services Digital Network) being one of the first networks, is considered to be prime candidate for evolution. For PSTN/ISDN evolution to NGN a phased approach is considered

Different evolutionary Scenarios with PSTN/ISDN emulation (adaptation to IP infrastructure) and with PSTN/ISDN simulation (session control over IP interfaces and infrastructure) are presently under consideration in ITU in order to provide reference for the evolution to NGN

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General Framework for migrating Telephony networks towards Next Generation Networks (NGN)

In markets with a high growth in traditional voice services (which is the case for most developing countries), substantial extensions will be required to the existing telephony network in order to cover the huge need for new lines. Established Service Providers will have to decide on how to extend their networks: using more traditional circuit-switched solutions or implementing a distributed network architecture, with a common, packet-based transport layer for voice and data.

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Draft Recommendation Y.piev - PSTN/ISDN evolution to NGN

This draft describes possible ways of evolving PSTN/ISDN to NGN. Both IP multi-media 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 this document.

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Core network evolution to NGN

a) CS-based evolution to NGN

- The call server (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 application server (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.

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Consolidation of local exchanges and remotes 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 local exchanges (LEs) are removed and all their functionalities such as control, accounting, etc. are transferred to those remaining LEs. Affected user access module (UAM), private automatic branch exchange (PABX), and access network (AN) are connected to the remaining LEs. Further consolidation occurs when user access modules (UAM) become remote user access modules (RUAM), which, are connected to the remaining LEs. Figure 11-1/Y.piev shows this preparatory step.
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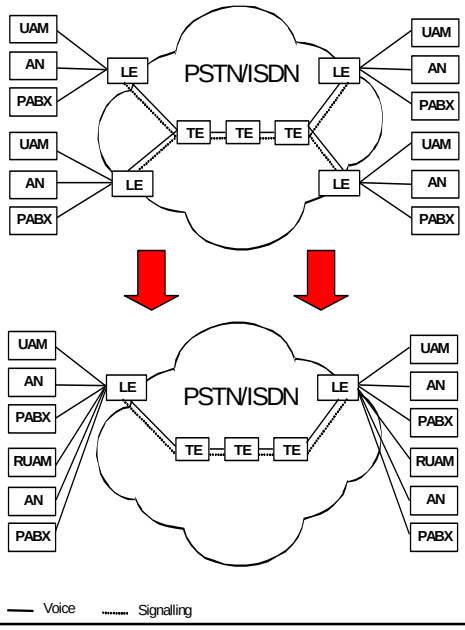
Figure 11-1/Y.piev: Preparation for evolution to NGN



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

- The most likely initial approach for evolution of PSTN/ISDN to PSN will involve a path that requires the PSTN/ISDN to co-exist with PSN during a transition period as shown in Figure 11-2/Y.piev. This scenario follows that approach. There are two steps in this scenario as explained below.

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

Step 1

- In this step some of the local exchanges (LEs) are replaced by the access gateways (AG). Functions originally provided by the removed LEs are furnished by the AGs and the call server (CS). In addition some of the access elements such as user access modules (UAMs), remote user access modules (RUAMs), and private automatic branch exchanges (PABXs) which were originally connected to the removed LEs become directly connected to access gateways (AGs). Additional access gateways (AGs) may also be deployed to support new subscribers can directly connect to them. The transit and signalling gateways (TGs & SGs) are deployed for interconnection between PSN and the TEs of the legacy network as well as other operators' PSTNs/ISDNs. The access and the transit gateways (AGs & TGs) are all controlled by the call server (CS).

Step 2

- In this step the remaining local exchanges (LEs) are replaced by the access gateways and the transit exchanges (TEs) are removed and their control functions are performed by call server (CS). The transit and signalling gateways (TGs & SGs) are deployed for interconnection between PSN and other operators' PSTNs/ISDNs. The access and the transit gateways (AGs & TGs) are all controlled by call server (CS).

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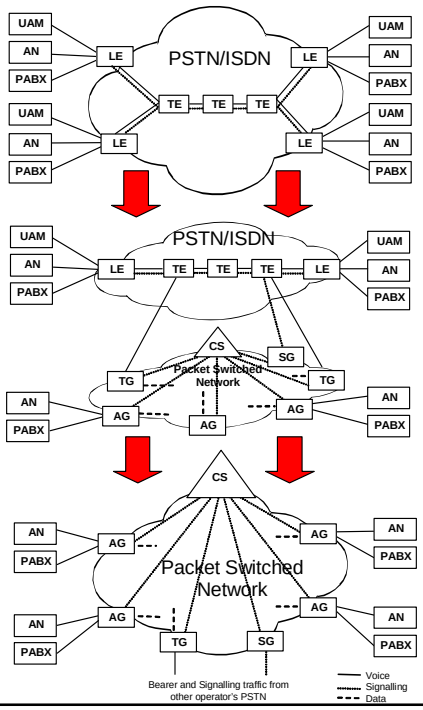

Figure 11-2/Y.piev: Realisation of scenario 1

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Scenario 2 – Use of SGs and TGs as an initial approach

Step 1

- In this step PSTN/ISDN is replaced by PSN and the TE functions are performed by the TGs and the SGs under the control of the call server (CS). The local exchanges (LEs) are connected to the PSN via transit gateways (TGs) and Signalling Gateways (SGs). The Transit and Signalling Gateways (TGs & SGs) are also deployed for interconnection between PSN and other operators' PSTNs/ISDNs.

Step 2

- In this step the local exchanges (LEs) and some of the access elements such as user access modules (UAMs) and remote user access modules (RUAMs) are removed and their functions are provided by the access gateways (AGs) and call server (CS). The private automatic branch exchanges (PABXs) are directly connected to access gateways (AGs). The access networks (ANs) are either replaced by the access gateways (AGs) or are connected to the access gateways (AGs). The transit and signalling gateways (TGs & SGs) are deployed for interconnection between PSN and other operators' PSTNs/ISDNs. The access and the transit (AGs & TGs) are all controlled by call server (CS).

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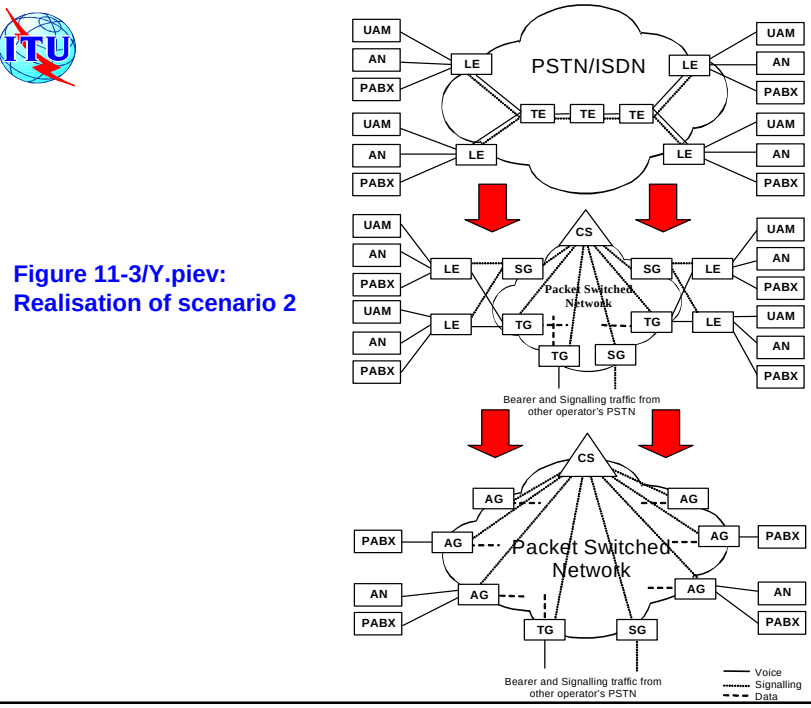

Figure 11-3/Y.piev: Realisation of scenario 2

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Scenario 3 – The one-step approach

- In this scenario the PSTN/ISDN is replaced with packet switched network (PSN) in only one step as shown in Figure 11-4/Y.piev. The local exchanges (LEs) are replaced by the access gateways (AGs) and their functions are divided between the AGs and the call server (CS). Specifically the call control and accounting functions are all transferred to the call server (CS). All access elements such as user access modules (UAMs), remote user access modules (RUAMs), and private automatic branch exchanges (PABXs) are connected to access gateways (AGs). The access networks (ANs) are either replaced by the access gateways (AGs) or are connected to packet based network (PBN) through the AGs. The transit gateways (TGs) under the control of the call server (CS), and the signalling gateways (SGs), are deployed to replace the TE functions and provide interconnection between PSN and other operators' PSTNs/ISDNs.

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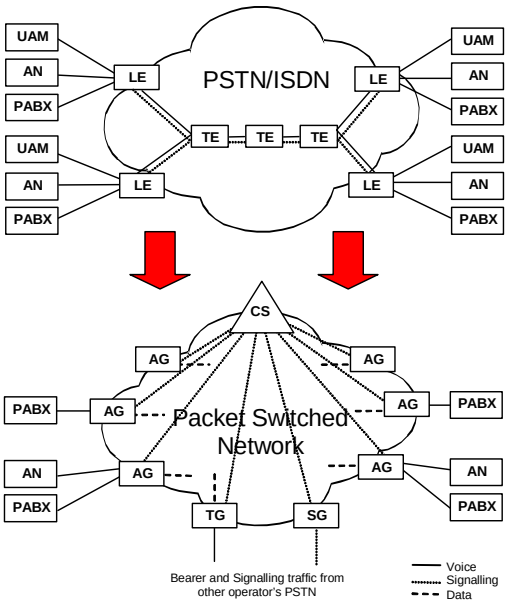

Figure 11-4/Y.piev: Realisation of scenario 3

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b) IMS-based evolution to NGN

- Figure 11-5/Y.piev 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 transit and signalling gateways (TGs & SGs) are deployed for interconnection between the NGN and other operators' PSTNs/ISDNs.

- **Concurrent CS-based and IMS-based evolution to NGN** implementations can occur when an existing operator 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 document.

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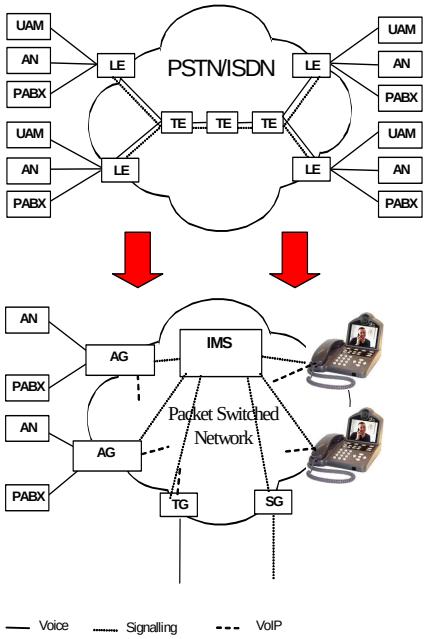

Figure 11-5/Y.piev: IMS-based PSTN/ISDN evolution to NGN

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Access Network evolution

Evolution of xDSL access to NGN

- Evolution of Access Network is shown in three possible steps.

Step 1

- There are three traditional Access Network interfaces: V5.x [3 & 4], analogue line POTS interface and digital ISDN interface. They connect subscribers to core PSTN/ISDN over local exchanges (LE). There is xDSL interface (where: 'x' set to A, S, I or V indicated Asymmetric, Symmetrical, Integrated or Very high bit-rate), which connects a legacy terminal over wired copper lines. Possible initial data link layer protocol for xDSL is ATM.
- Legacy users are able to select narrowband and broadband access at the same time. There is subscriber's end-user equipment (xDSL modem) and a digital subscriber line access multiplexer (DSLAM) on the operator side. Since xDSL interfaces enable users to connect to the Internet it will be used to connect the legacy terminals to NGN.
- Access Network, for another user domain with V5.x [3 & 4] interface can be left as it is shown on figure or it can be completely replaced by access gateway (AG) connected to NGN directly.

Step 2

- In this step LE and V5.x [3 & 4] entities are replaced by an AG. Customer premise equipment (CPE) with xDSL modem supported legacy subscribers and may enable them broadband access to NGN. CPE with xDSL modem should have an adaptation function to enable legacy terminal communicate with other subscribers connected to NGN. IP subscribers may also use xDSL interface as transport medium to NGN. Protocol for xDSL interface may be Ethernet which enable broadband data flows and services, e.g. video on demand (VoD), broadcast TV (BTV), voice over IP (VoIP).

Step 3

- In this step 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.

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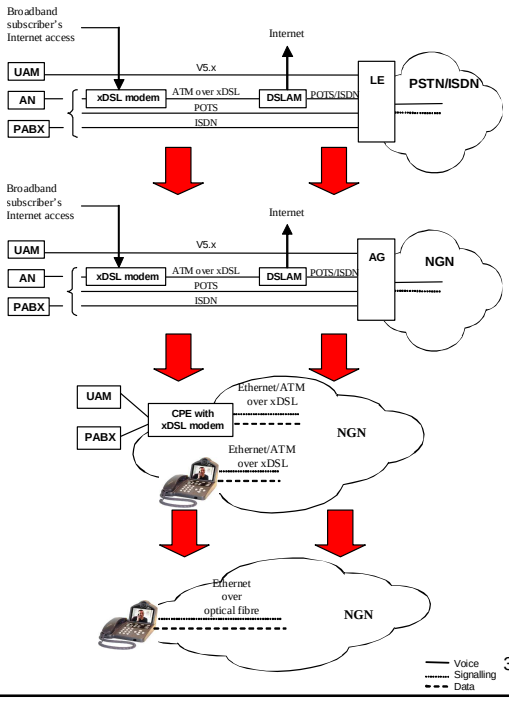
Figure 11-6/Y.piev: Evolution of xDSL access to NGN



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Definitions and Abbreviations

This draft uses or defines the following terms:

- **3.1 Media Server (MS):** A network element providing the media resource processing function for telecommunication services in NGN.
- **3.2 NGN-AG:** An Access Gateway, which interfaces to IP multi-media component using SIP and to PSTN/ISDN terminals, and providing PSTN/ISDN simulation services. Such a gateway implements both a media gateway function and a media gateway controller function as defined in IETF RFC 2805 [22] and supports the provision of voice-based services to analogue lines and ISDN lines. The gateway is "call control aware" (due to the termination of SIP) as opposed to "call control agnostic" H.248-based access media gateways.
- **3.3 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.
- **3.4 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.

Abbreviations and acronyms

- This draft uses the following abbreviations.
- ACS Access Call Server
- AG Access Gateway
- AS Application Server
- AN Access Network
- ATM Asynchronous Transfer Mode
- BCS Breakout Call Server
- BICC Bearer Independent Call Control
- BTV Broadband TV
- CAS Channel Associated Signalling
- CBR Constant Bit Rate
- CC Content of Communication
- CCS Common Channel Signalling
- CDR Call Detail Record
- CPE Customer Premise Equipment
- CS Call Server
- DSL Digital Subscriber Line
- DSLAM Digital Subscriber Line Access Multiplexer
- ETS Emergency Telecommunications Services
- FTTC Fibre-To-The-Curb
- FTTH Fibre-To-The-Home
- GCS Gateway Call Server
- GoS Grade of Service
- ICS Interworking Call Server
- IMS IP Multimedia Subsystem
- IN Intelligent Network
- INAP Intelligent Network Application Part

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Definitions and Abbreviations (cont.)

IP	Internet Protocol
IRI	Intercept Related Information
ISDN	Integrated Service Digital Network
LE	Local Exchange
LEA	Law Enforcement Agencies
LL	Leased Line
MS	Media Server
OSS	Operations Support System
PABX	Private Automatic Branch Exchange
PCM	Pulse Code Modulation
POTS	Plain Old Telephone Service
PRI	Primary Rate Interface
PSAP	Public Safety Answering Point
PSN	Packet Switched Network
PSTN	Public Switching Telephone Network
QoS	Quality of Service
RUAM	Remote User Access Module
SCE	Service Creation Environment
SCP	Service Control Point
SG	Signalling Gateway
SIP	Session Initiation Protocol
SSF	Service Switching Function
SSP	Service Switching Point
STP	Signalling Transfer Point
TDM	Time Division Multiplexing
TDR	Telecommunications for Disaster Relief
TE	Transit Exchange
TG	Trunking Gateway
TMN	Telecommunication Management Network
UAM	User Access Module
VOD	Video On Demand
VoIP	Voice over IP
xDSL	any DSL

THANK YOU VERY MUCH FOR YOUR ATTENTION

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