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Title: New draft Recommendation Y.NGN-DSL

The attached document was accepted as the preliminary basis for the development of a new draft Recommendation Y.NGN-DSL, and as an output document from this meeting.

However, this document has not received a detailed review and a number of concerns were raised regarding the new functionalities identified and the relationship to those in Y.2012 (FRA).

Further contributions have been invited on this document, taking the above considerations into account, in order to progress this new draft Recommendation.

The document is designed to capture the key DSL Forum Technical Reports considered to be relevant to use of DSL work in the context of Next Generation Networks.

At the meeting it was agreed to provide more information regarding the mapping of the DSL architecture and terminology to that described in Y.2012.

This document is also being liaised to the DSL Forum seeking their comments and collaboration.

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Draft Recommendation Y.NGN-DSL: Roadmap for DSL based systems in Next Generation Networks

Summary

This Recommendation provides a Roadmap for the the use of DSL Based Systems in Next Generation Networks (NGNs).

This Recommendation describes how the set of specifications developed by the DSL Forum may be use in context of Next Generation Networks.

Source

Contents

TBD

1 Introduction

This Recommendation provides an introduction to the use of specifications developed by the DSL Forum for use in Next Generation Networks (NGNs).

2 Scope

The scope of this Recommendation is the provision of Next Generation Network architectures over DSL technology. The DSL technology itself is outside the scope of this Recommendation but is assumed as the underlying transport network to support Next Generation Network architectures. This Recommendation is concerned with the architecture(s) superimposed over DSL transport to provide IP-based services and related applications for Next Generation Networks.

3 References

The following ITU-T Recommendations and other references contain provisions that, through references in this text, constitute provisions of this Recommendation. At the time of publication, all the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of consulting the most recent editions of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] DSL Forum TR-058, Multi-Service Architecture and Framework Requirements.

[2] DSL Forum TR-059, DSL Evolution – Architecture Requirements for Support of QoS-enabled IP Services.

[3] DAVIC 1.4.1 Specification Part 2, System Reference Models and Scenarios.

[4] DSL Forum TR-102, Service Interface Requirements for TR-058 Architectures.

[5] DSL Forum TR-092, Broadband Remote Access Server Requirements Document

[6] DSL Forum TR-094, Multi-Service Delivery Framework for Home Networks.

[7] DSL Forum TR-069, CPE WAN Management Protocol.

[8] DSL Forum TR-098, Gateway Device Version 1.1 Data Model for TR-069.

[9] DSL Forum TR-064, LAN-Side DSL CPE Configuration.

[10] UPnP Device Architecture, Version 1.0.1, May 6, 2003, http://www.upnp.org/download/Clean%20UPnPDA101-20030506.doc

[11] DSL Forum TR-124, Functional Requirements for Broadband Residential Gateway Devices.

[12] DSL Forum TR-111, Applying TR-069 to Remote Management of Home Networking Devices

[13] DSL Forum TR-133, TR-064 Extensions for Service Differentiation

4 Definitions

This Recommendation defines the following terms.

TBD

5 Abbreviations

This Recommendation uses the following abbreviations.

ASP	Application Service Provider
ACS	Auto-Configuration Server
BRAS	Broadband Remote Access Server
CPE	Customer Premise Equipment
DAVIC	Digital Audio Visual Council
DCP	Device Control Protocol
DSCP	Diff-serv Code Point
DSL	Digital Subscriber Line
DSLF	DSL Forum
GPON	Gigabit-capable Passive Optical Networks
IETF	Internet Engineering Task Force
IEEE	Institute of Electrical and Electronics Engineers
EMS	Element Management System
IP	Internetwork Protocol
ISP	Internet Service Provider
LAN	Local Area Network
L2TP	Layer 2 tunneling protocol
L2TS	Layer 2 tunneling server
NAPT	Network Address and Port Translation
NMS	Network Management System
NSP	Network Service Provider
PPP	Point to point protocol
PPPoE	PPP over Ethernet
QoS	Quality of Service
RG	Routing Gateway (sometimes also known as Residential Gateway)
RAN	Regional/Access Network
RFC	Request for Comment (IETF document)
SMS	Subscriber Management System
TR	(DSL Forum) Technical Report

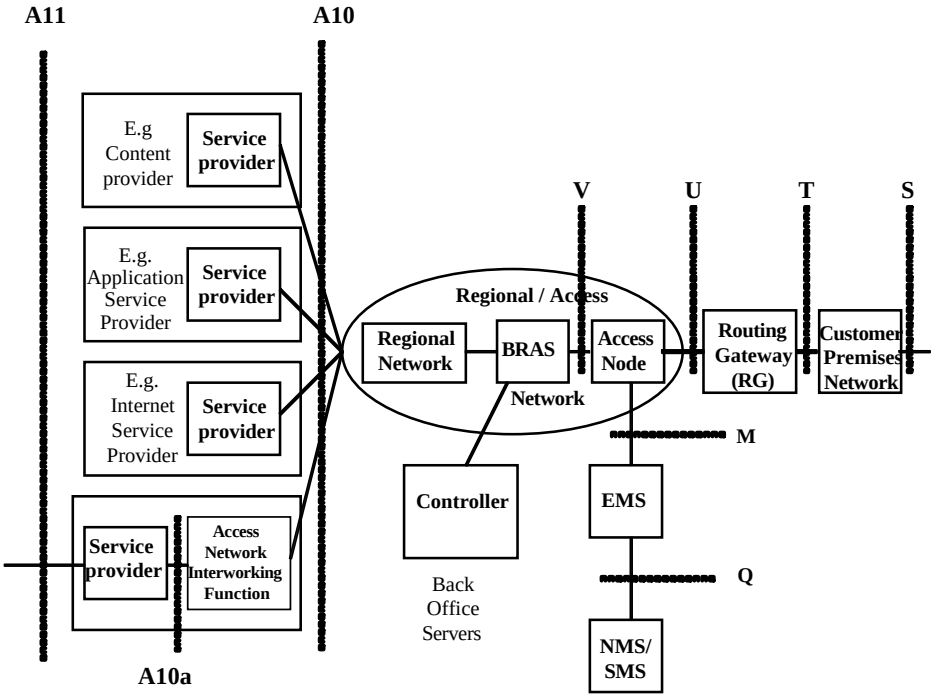
UPnP Universal Plug and Play

UDA UPnP Device Architecture

6 Reference Point Configuration Architecture

The reference points identified in the DSLF in TR-058 [1] are shown in the figure below.

The V, U, S and T reference points correspond to their traditional ITU-T usage. The A10 and A11 reference correspond to their usage in DAVIC [3].



Legend:

BRAS	Broadband Remote Access Server
EMS	Element Management System
NMS	Network Management System
RG	Routing Gateway
SMS	Subscriber Management System

Figure 1 - Reference Point Model

7 Multi-service, multi-provider, multi-user, multi-device operation

The reference model shown above allows each instance of the service invocation to be individually distinguished by the controller and to be allocated with a distinct session and bearer. This capability will

allow several real time multimedia services to operate simultaneously, each controlled separately. This shown in the figure below.

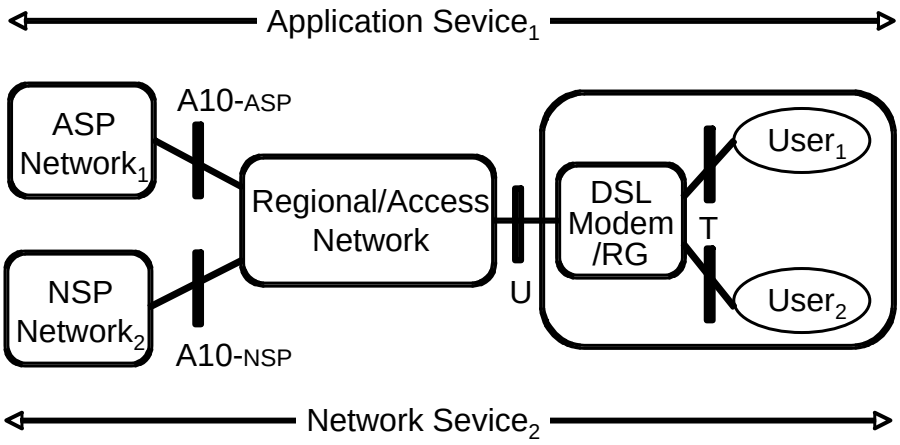


Figure 2 - Simultaneous access to many service providers

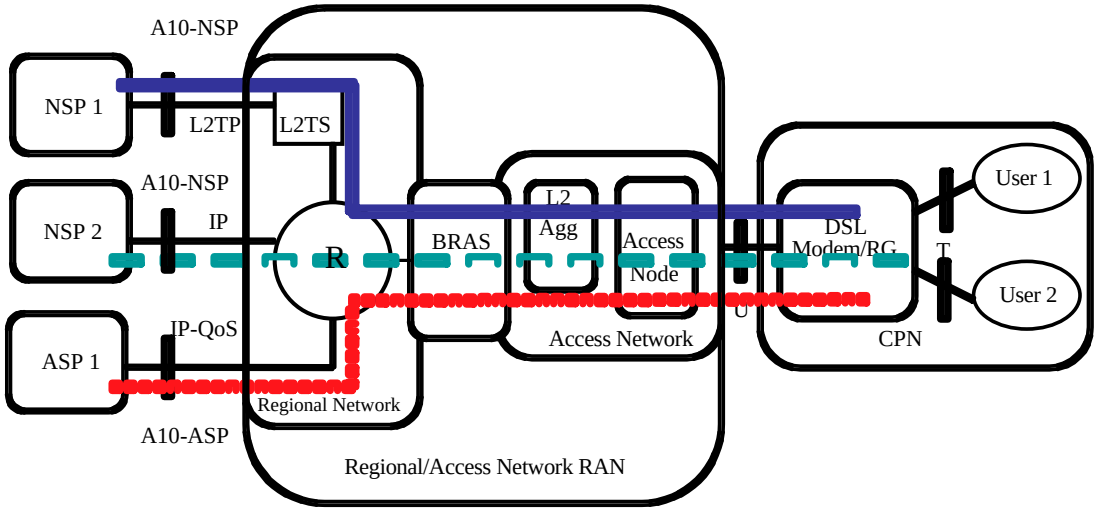
The TR-059 architecture increases the types and number of access sessions that a subscriber would typically establish to a service provider. Whereas previously there had been just one access session to an ISP, the TR-059 architecture identifies multiple access sessions with three basic types as shown in figure 3.

Community NSP – Shown in the figure below as the solid line between the RG and NSP_1, this type of access session is established between an RG and an NSP. It is called the *Community* NSP connection because all the devices within the Customer Premises Network share the connection to the NSP using the NAPT feature of the RG. Because the Community NSP connection is given the *Default Route* at the RG there can be only one. This connection is typically set up to an ISP in order to provide Internet access to all the devices in the Customer Premises Network.

Personal NSP – Shown in the figure below as the dashed line between $User_1$ and NSP_2, this type of access session is established between a device within the Customer Premises Network and an NSP. It passes through the RG at the Ethernet (PPPoE) level. It is called the *Personal* NSP connection because only the device within the Customer Premises Network from which the connection was established can access the NSP. This avoids using the NAPT feature of the RG. This connection is typically set up to an ISP or a corporation in order to provide private or personalized access, or any access that cannot traverse the NAPT sharing mechanism at the RG.

ASP – Shown in the figure below as the dotted line between the RG and ASP_1, this type of access session is established between an RG and the ASP network. It is always a single

connection and is always shared by all the ASPs. Because the Community NSP connection is given the *Default Route* at the RG, the ASP connection must provide the RG with a list of routes to the ASP network. Also because there is not a default route to the ASP network, it is not possible to provide typical Internet access through the ASP connection. This connection is typically set up to the ASP network in order to provide application-specific and QoS-enabled access among all the applications in the ASP network and all the devices in the Customer Premises Network.



Legend:
CPN Customer premise network
L2TP Layer 2 tunneling protocol
L2TS Layer 2 tunneling server

Figure 3 - Access Session types

8 Use Case Scenarios and related Information Flows

TR-102 [4], Service Interface Requirements for TR-058 Architectures.

contains a number of use cases and specifies the related information flows.

Section 4 of TR-102 describes five exemplary usage cases demonstrating the operational application framework, namely:

- Videoconferencing;
- Video on Demand;
- Turbo Button;

- Gaming;
- VoIP.

In Section 5, the high level application flows from the usage cases in Section 4 are broken down into a common set of detailed network flows showing how the activities involving the Regional/Access Network (RAN) might be accomplished. This includes new information on the involvement of network elements (DSL Service Manager, database, etc.). In particular, the message interface is seen as a simple andaccessible interface to a potentially more complex policy management framework, like IMS (IP Multimedia Subsystem – defined by 3GPP).

Section 6 defines the message interfaces and a basic set of QoS and bandwidth capabilities in conjunction with the A10 interface to get at the variable services provided by TR-058.

9 Broadband Remote Access Server Requirements Document

Requirements for the BRAS are contained in TR-092 [5].

The BRAS can perform several logical functions (e.g. LAC, IP router, or a MPLS PE router) as it aggregates user sessions from the access network. The requirements included in this document should be applied broadly across all of these logical functions unless where explicitly stated. In addition to providing basic aggregation capabilities, the BRAS is also the injection point for providing policy management and IP QoS in the Regional and Access Networks.

The BRAS is the last IP aware device between service providers (ASPs and NSPs) and the customer network, and as such is leveraged to manage the IP traffic through the layer 2 Access Network. To accomplish this, the BRAS will need to provide a congestion management function that will allow the synthesis of IP QoS through downstream elements that are not QoS aware, which enables DSL providers to support enhanced IP applications.

9.1 Protocols to and from end users

The DSL Forum, specifies five different protocol stacks for the U Interface for Accessing data Networks. These are shown in summary in the figure below.

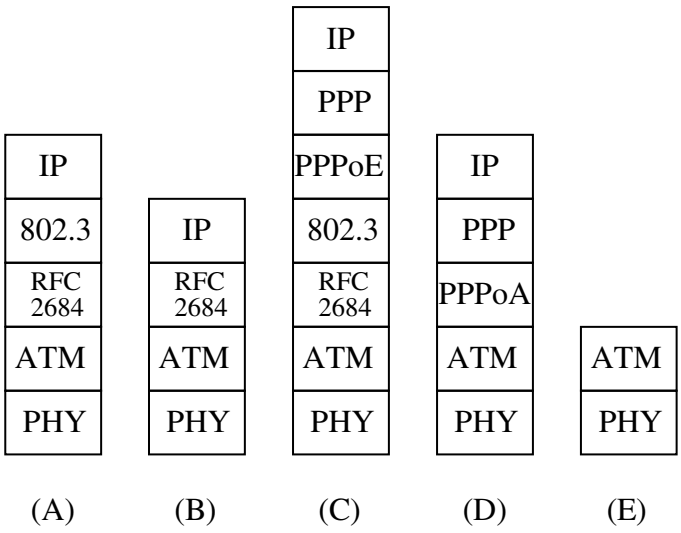


Figure 4 - Protocols to and from end users

TR-092 specifies the requirements for using the protocols shown above. These requirements make normative reference to other relevant DSL Forum TRs as well as relevant IEFT RFCs and IEEE Standards.

9.2 Protocols used to and from NSPs and ASPs

The protocols used to and from NSPs and ASPs are shown in the figure below, and again TR-092 specifies the requirements for using these protocols. These requirements make normative reference to other relevant DSL Forum TRs as well as relevant IEFT RFCs and IEEE Standards.

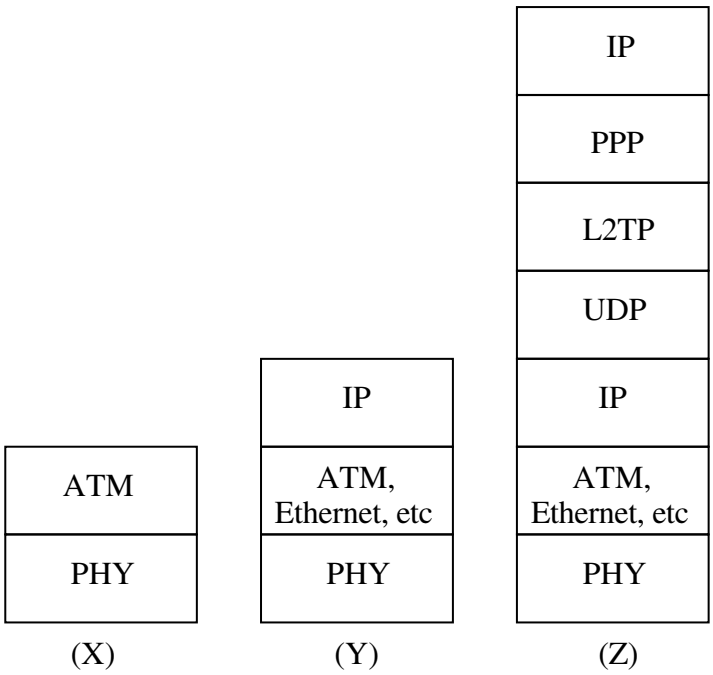


Figure 5 - Protocols to and from NSPs and ASPs

10 Multi-Service Delivery Framework for Home Networks

TR-094 [6] specifies the Multi-Service Delivery Framework for Home Networks, providing:

- the ability to support multiple logical data connections on the same physical access technology; and,
- the ability to tailor those connections with different qualities of transmission characteristics (i.e., quality of service (QoS)).

The Broadband Access Server (BRAS) is a key network-side component.

The BRAS performs multiple functions in the network. Its most basic function is to provide aggregation capabilities between the Regional/Access Network and the NSP/ASP. For the aggregation Internet traffic, the BRAS serves as a L2TP Access Concentrator (LAC) tunneling multiple subscriber PPP sessions directly to an NSP or switched through a L2TS. It also performs aggregation for terminated PPP sessions or routed IP session by placing them into IP VPNs or 802.1Q VLANs. The BRAS also supports ATM termination and aggregation functions.

Beyond aggregation, the BRAS is also the injection point for providing policy management and IP QoS in the Regional and Access Networks. The BRAS is fundamental to supporting the concept of many-to-many access sessions.

Policy information can be applied to terminated and non-terminated sessions. For example, a bandwidth policy may be applied to a subscriber whose PPP session is aggregated into an L2TP tunnel and is not terminated by the BRAS. However, sessions that terminate on (or are routed through) the BRAS can receive per flow treatment because the BRAS has IP level awareness of the session. In this model, not only can the aggregate bandwidth for a customer be controlled but also the bandwidth and treatment of traffic on a per application basis.

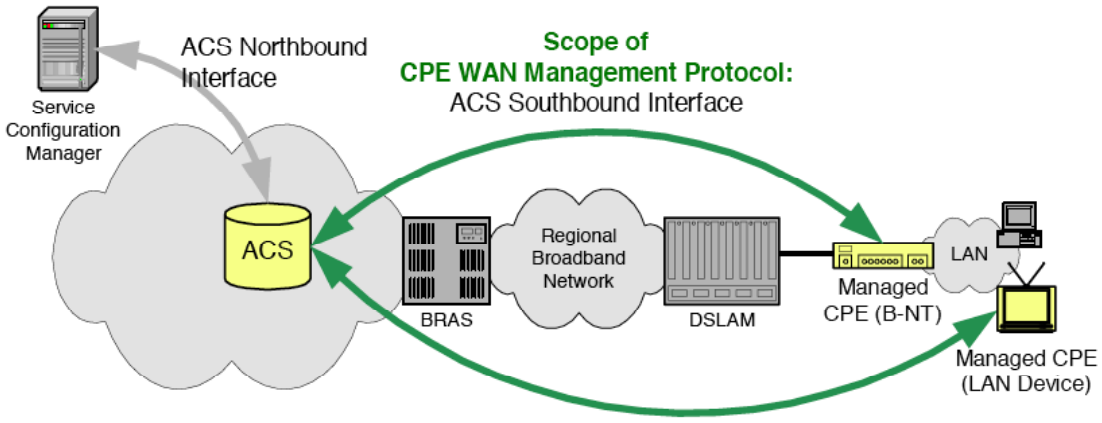
TR-094 identifies a number of applications that the home network will be expected to support, the functionality that a home network must deliver to meet the application requirements, and the reference architecture for a home network that will deliver such functionality.

TR-094 covers the three primary service areas associated with the“Triple Play” of voice, video, and data services. In particular, the following areas are addressed:

- Best effort Internet access (Simple Web Surfing)
- Derived voice lines (VoIP based)
- Near Video on Demand - VoD (store and forward)
- Video on Demand - VoD (streaming video)
- Audio, image and video distribution
- Bandwidth on Demand (Turbo Button)
- Multiplayer gaming using either PCs or console devices
- Home automation (Telemetry and control)
- Remote Education

11 Management of Customer Premise Equipment (CPE)

The basic framework for managing the equipment on the customer premise is specified in TR-069 [7] as shown in the figure below (taken from TR-069).



Legend:

ACS	Auto-Configuration Server
CPE	Customer Premise Equipment
B-NT	Broadband Network Terminating Unit
BRAS	Broadband Remote Access Server

Figure 6 - Framework for management of customer premise equipment

The CPE WAN Management Protocol defines a mechanism that encompasses secure auto-configuration of a CPE, and also incorporates other CPE management functions into a common framework.

The protocol architecture specified in TR-069 is shown below.

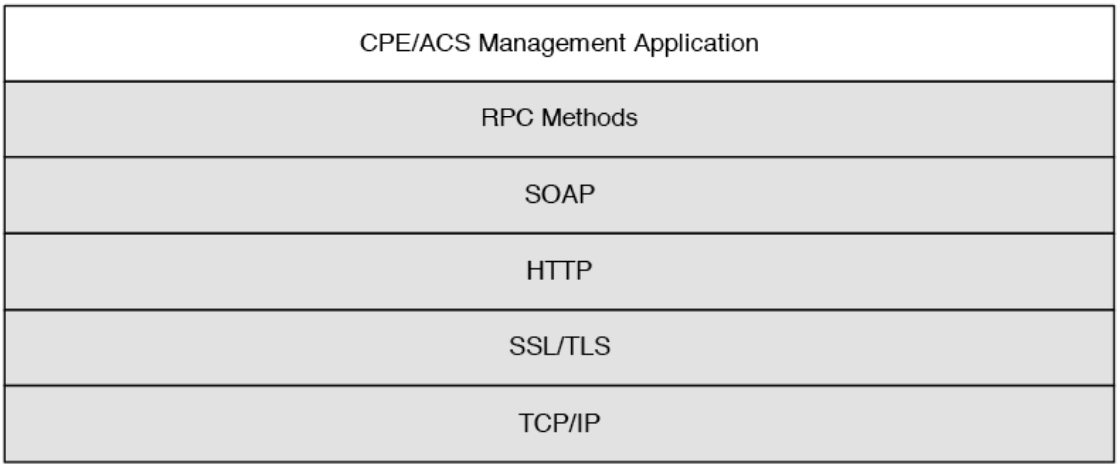


Figure 7 - Management Protocol Architecture

The RPC Method Specification is specified in Appendix B of TR-069 and defines a generic mechanism by which an ACS can read or write Parameters to configure a CPE and monitor CPE status and statistics. The particular list of defined Parameters for an Internet Gateway Device is specified in Appendix B of TR-069.

It should be noted that TR-098 [8] specifies an extended set of parameters for TR-069 for the gateway device, particularly with respect to advanced QoS-based services.

12 LAN-Side DSL CPE Configuration

TR-064 [9] describes a specific implementation to be used for DSL CPE LAN-side configuration. It describes the protocol stack, discovery, security, and the XML structure to be used.

The Device Control Protocol (DCP) is compliant with UPnP[1] Device Architecture 1.0 (UDA) [10].

[1] Universal Plug and Play.

Aspect	Solution
Management Protocol	Standards based XML over SOAP protocol.
Parameter Model	Parameters defined using UPnP model as base, disallowing values and parameters that are inconsistent with DSL model, and adding objects as needed for DSL CPE.
Security	HTTP Digest Authentication; optional SSL 3.0 or TLS 1.0 encryption.
CPE Type	Supports Bridge/Router/PPPoE on-board IP pass-thru CPEs.
Management Usage	CPE turn-up, status determination, monitoring, diagnostics.
CPE discovery	Standards-based DHCP and SSDP device discovery.
OS Support	CPE management app with integrated XML over SOAP stack to operate on any OS, native XML/SOAP OS support is not required or desired.
Proprietary/Open	Standards-based with open interface published.

Figure 8 - General features of LAN-Side DSL CPE Configuration

13 Functional Requirements Residential Gateways

TR-124 [11] Specifies a superset of requirements for broadband Residential Gateway devices that are capable of supporting a full suite of voice, data, broadcast video, video on demand and two-way video applications in broadband networks.

This document specifies a baseline for a Residential Gateway device and the application functions needed to support service delivery in routed and bridged broadband network architectures. Devices can be specified that will operate on any of the different types of DSL Forum defined network architectures. This allows service providers to configure a Residential Gateway device supporting specified TR-124 modular requirements locally via TR-064 and Web Graphical User Interface or remotely via TR-069. The requirements for a number of other related implementation features are specified, such a number of sessions to be supported, device related information, etc.

TR-124 provides optional requirements modules for various physical broadband interfaces (e.g., xDSL, Ethernet, GPON) and home networking (LAN) interfaces which may be implemented on Residential Gateways to meet local service provider needs.

Appendixes C and D provide many example configurations showing simultaneous use of session types by various CPE devices. Appendix F contains a Product Profile Template.

It should also be noted that TR-111 [12], specifies the application of TR-069 to the remote management of home networking devices, and contains a number of related information flows.

14 Quality of Service Considerations

TR-133 provides mappings between layer 2 and layer 3 QoS parameters for automatic marking of DSCP (layer 3) based upon Ethernet Priority (layer 2) and vice versa.

Layer 2					Layer 3			
ATM	VLAN		WMM / 802.11e		DiffServ		IP Precedence	
Class	VLAN User Priority	Designation	WME Access Category	Designation	DSCP	PHB	IP Precedence (Obsolete)	Designation
UBR	001	BK	AC_BK	Background	000000	Default	000	Routine
	010	spare						
UBR	000	BE	AC_BE	Best Effort	000000 000000	Default CS0	000	Routine
UBR	011	EE	AC_BE	Best Effort	001110 001100 001010 001000	AF13 AF12 AF11 CS1	001	Priority
VBR-nrt	100	CL	AC_VI	Video	010110 010100 010010 010000	AF23 AF22 AF21 CS2	010	Immediate
VBR-nrt	101	VI	AC_VI	Video	011110 011100 011010 011000	AF33 AF32 AF31 CS3	011	Flash
VBR-rt	110	VO	AC_VO	Voice	100110 100100 100010 100000	AF43 AF42 AF41 CS4	100	Flash Override
CBR	110	VO	AC_VO	Voice	101110 101000	EF CS5	101	CRITIC/ECP
CBR	111	NC	AC_VO	Voice	110000 111000	CS6 CS7	110 111	Internetwork Control Network Control

Note: grayed items are added to allow two-way mapping between layer-2 and layer-3 QoS.

Figure 9 - Default Layer 2/3 QoS Mapping

Shaping and rate limiting should also take place at the entry into the access network, rather than allowing the last mile to be uncontrolled. Additionally, it allows services to be based on a “policed/manageable” service level agreement with the customer. The following example is taken from TR-059.

There are multiple access sessions supported in this model, however, all traffic is classified and scheduled in a monolithic system. So, while it might appear at first that the Diffserv queuing and scheduling might apply only to IP-aware access – in fact all access, IP, Ethernet, or PPP is managed by the same system that adheres to the Diffserv model.

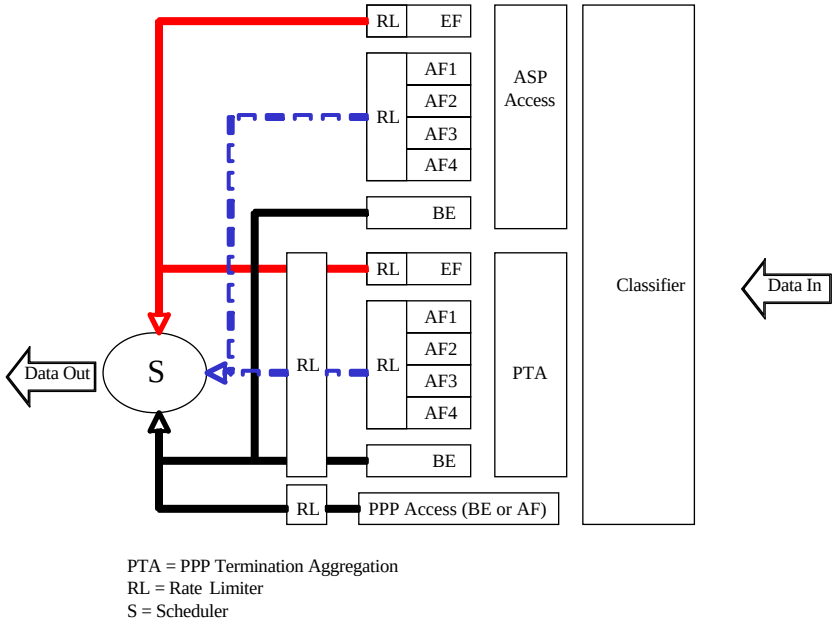


Figure 10 -Queuing and Scheduling Example for RG

15 Roadmap summary

The figure below provides a pictorial illustration of key DSL Forum documents and their relationship to architectural distribution of components.

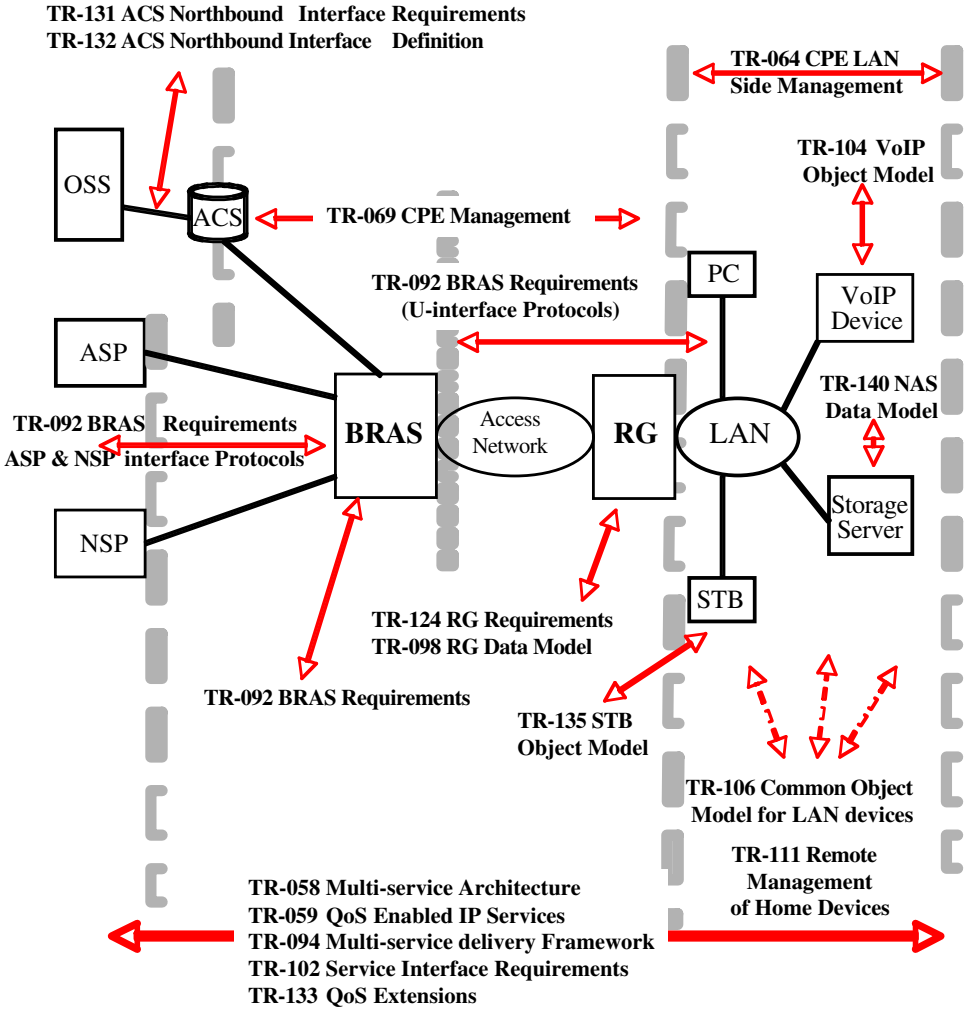


Figure 11 - Roadmap for relevant DSL Forum Technical Reports

This figure is not exhaustive in identifying all the relevant Technical Reports. Some of the TRs shown make reference to other applicable TRs.

A full list of available DSL Forum Technical Reports is contained in Appendix 1.

Appendix 1: DSL Forum Reports

Technical Report	Title
TR-001	ADSL Forum System Reference Model
TR-003	Framing and Encapsulation Standards for ATM Packet Mode
TR-004	Network Migration
TR-005	ADSL Network Element Management
TR-007	Interfaces and System Configurations for ADSL : Customer Premises
TR-008	Default VPI/VCI for FUNI Mode Transport: Packet Mode
TR-009	Channelization for DMT and CAP ADSL Line codes
TR-010	Requirements and Reference Models for ADSL Access Networks: Service Network Architecture Group (SNAG) Document
TR-011	End to End Packet Mode Architecture with Tunneling and Service Selection
TR-012	Broadband Service Architecture for Access to Legacy Data Networks over ADSL (PPP over ATM)
TR-013	Interface & Configurations for ADSL: Central Office
TR-015	CAP Line Code Specific MIB
TR-018	References and Requirements for CPE architectures for Data Access
TR-019	ADSL Forum Recommendation for Physical Layer of ADSLs with a Splitter
TR-020	ADSL Forum Recommendation for Physical Layer of ADSLs without a Splitter
TR-021	ADSL Forum Recommendation for ATM Layer of ADSLs
TR-022	Operation of ADSL-based Networks
TR-023	Overview of ADSL Testing
TR-024	DMT Line Code Specific MIB
TR-025	Core Network Architecture for Access to Legacy Data Network over ADSL
TR-026	T1.413 Issue 2, ATM-based ADSL ICS
TR-027	SNMP-based ADSL Line MIB
TR-028	CMIP Specification for ADSL Network Management
TR-029	ADSL Dynamic Interoperability Testing
TR-030	ADSL EMS to NMS Functional Requirements
TR-031	ADSL ANSI T1.413 – Conformance Testing
TR-032	CPE Architecture Recommendations for Access to Legacy Networks
TR-033	ITU-T G.992.2 (G.lite) ICS

TR-034	Proposal for Alternative OAM Communications Channel Across U Interface
TR-035	Protocol Independent Object model for ADSL EMS-NMS Interface
TR-037	Network Management Operations: DSL CPE Auto-configuration
TR-038	DSL Service Flow-Thru Management Overview
TR-040	Aspects of DSL
TR-041	CORBA Specification for DSL EMS-NMS Interface
TR-042	ATM Transport over ADSL Recommendation
TR-043	Protocol at the U Interface for Accessing data Networks using ATM/DSL
TR-044	Auto-configuration for Basic Internet IP-based Services
TR-056	Network Migration
TR-057	VDSL Network Element Management
TR-058	Multi-Service Architecture & Framework Requirements
TR-059	DSL Evolution- Architecture Requirements for the Support of QoS Enabled IP Service
TR-060v2	Interoperability Test Plan for SHDSL
TR-061	Interface and System Configuration for ADSL: Customer Premises
TR-062	Auto-Configuration for the Connection Between the DSL Broadband Network Termination (B-NT) and the Network using ATM (TR-037 update)
TR-063	Update to TR-057
TR-064	LAN-Side DSL CPE Configuration Specification
TR-065	FS-VDSL EMS to NMS Interface Functional Requirements
TR-066	ADSL Network Element Management (Update to TR-005)
TR-067	ADSL Interoperability Test Plan (Formerly TR-048)
TR-068v2	Base Requirements for an ADSL Modem with Routing
TR-069	CPE WAN Management Protocol
TR-070	SCM Specific Managed Objects in VDSL Network Element
TR-090	Protocol Independent Object Model for Managing Next Generation ADSL Technologies
TR-092	Broadband Remote Access Server (BRAS) Requirements Document
TR-094	Multi-Service Delivery Framework for Home Networks
TR-098	Gateway Device Version 1.1 Data Model for TR-069
TR-102	Service Interface Requirements for TR-058 Architectures
TR-104	Provisioning Parameters for VoIP CPE
TR-106	Data Model Template for TR-069 Enabled Devices
TR-110	Reference Models for VoIP Configurations in the DSL Home

TR-111	Applying TR-069 to Remote Management of Home Networking Devices
TR-124	Functional Requirements for Broadband Residential Gateway Devices
TR-126	Triple-play Services Quality of Experience (QoE) Requirements and Mechanisms
TR-128	Addendum to TR-090
TR-129	Protocol Independent Management Model for Next Generation DSL Technologies
TR-130	xDSL EMS to NMS Interface Functional Requirements
TR-131	ACS Northbound Interface Requirements
TR-132	ACS Northbound Interface Definition
TR-133	TR-064 Extensions for Service Differentiation
TR-135	STB Object Model
TR-140	NAS Data Model

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