

BroadbandSuite 4.1: Management & Provisioning for Quality Service Delivery

The latest Broadband Forum release, BroadbandSuite™ 4.1, provides techniques and tools to provision, measure and manage each segment of the broadband network to ensure quality delivery of Connected Home services. This release looks at the ever expanding ecosystem of the Connected Home and addresses for the first time service requirements of triple play and beyond to include machine-to-machine applications including metering, monitoring as well as teleworking support.

Recognizing that more than 60% of the world's broadband deployments are via Digital Subscriber Lines (DSL), a group of the specifications in this release deal specifically with how to engineer DSL for enhanced speed, stability and service delivery. These specifications make up what is referred to as the DSL Quality Management (DQM) Suite which describes techniques using DSL line performance, status and test data, as well as other data as inputs to measure throughput and diagnose line functions. The specifications then prescribe potential corrective actions to alleviate problems or improve performance.

Topics covered in the BroadbandSuite 4.1 release include:

- DSL Quality Management (DQM) Suite of TRs
- Broadband Architecture recommendations
- ADSL2plus & Splitter functional measurements
- IPTV Performance Monitoring and Diagnostics
- BBF Value Proposition for Connected Home white paper
- BroadbandSuite 4.1 Release Companion Guide

What is DSL Quality Management (DQM)?

The DSL Quality Suite (DQS) is composed of several documents which encompass various topics in the field of ensuring the quality and stability of DSL lines, i.e. DSL Quality Management (DQM). DQM is a generic term for techniques which use DSL line performance, status and test data, and other data as inputs to an analysis and diagnosis function which leads to a potential (soft or hard) corrective action whose aim is the amelioration of problems or improved performance. If a problem cannot be solved by a new set of DSL parameters then DQM provides a diagnosis for other actions to be taken.

The current DQM documents include:

- [TR-188](#) DSL Quality Suite
- [TR-198](#) DQS: DQM Systems and Functional Architecture and Requirements
- [TR-252](#) xDSL Protocol-Independent Management Model

- [TR-138](#) Validation of G.997.1 Parameters

DQM techniques are frequently tied to the service components actually being delivered over a specific DSL line. As far as the types of services, IPTV is a critical consideration as well as all the components of today's multi-play options, dealt with either alone or bundled onto the DSL line. Therefore additional documents are important companions to this work and part of BroadbandSuite 4.1:

- [TR-160](#) IPTV Performance Monitoring & Diagnostics
- [TR-105](#) ADSL2/ADSL2plus Functionality Test Plan
- [TR-127](#) Dynamic Testing of Splitters and In-line Filters with xDSL Transceivers
- [MR-239](#) Broadband Forum Value Proposition for the Connected Home

[TR-188](#) DSL Quality Suite

In the light of broadband as tomorrow's universal means for communications and a multitude of other services, it is an unavoidable need to tackle the issue of DSL stability and quality by means of advanced and efficient techniques and tools. As the penetration of broadband increases and the related service offers become more and more structured, such techniques represents a tool (or tools) of utmost importance. This is to guarantee overall service quality and performance to customers as well as consolidate broadband as a main service-enabling network platform for Service Providers.

This Technical Report aims to specify a framework for the management of Digital Subscriber Line (DSL) quality. The objective is to provide a common reference to allow homogeneous definition of further documents devoted to specific management aspects. The building bricks for the effective management of all the quality and stability aspects of DSL lines are described, to be used both by Vendors and Service Providers. This framework document identifies a collection of Broadband Forum documents already existing or planned, ranging from nomenclature aspects to requirements and guidelines, and finishing with best practices for Service Providers.

The DQS reference categories established in this document are as follows:

- **Management techniques and nomenclature** category relates to definitions which clarify the use of terminology and acronyms related to DQM and the description of the techniques and parameters to enhance DSL quality and stability. [Coming soon WT-197](#)
- **Requirements** category addresses the features and capabilities needed on the equipment and/or management systems to effectively implement the management techniques for DSL quality and stability. [See TR-198](#)
- **Configuration** category deals with the line profiles suggested for specific services or specific DSL technologies when addressing the trade-off between quality/stability and other link characteristics such as bitrate, delay, etc. [See TR-176 and TR-165](#)
- **Best practices** category depicts currently adopted Network Operation practices. [Coming soon MR-180: IPTV over DSL Anywhere](#)

[TR-198 DQS: DQM systems functional architecture and requirements](#)

[TR-198](#) is a component of the DQS (DSL Quality Suite) and defines the following DQM loop techniques: monitoring, analysis and diagnosis, and (soft or hard) corrective action. This concept can be applied to operational phases like Provisioning and Assurance typically targeting a single DSL line. DQM techniques can be conceived also for the Trend Analysis phase encompassing groups of DSL lines and aggregation of NEs. Finally DQM can also feed the Network or the Infrastructure Planning phases which again involve wide portions of the access network.

A functional architecture for DQM is described and the interfaces required between functional blocks identified. DQM systems require the collection of performance, status, test and other data which is analyzed to enable decisions on re-configuration or other actions to be made. The detailed requirements for a data collection function and the interfaces to it are given and encompass the data to be collected, the mechanism for collection and the performance of the interfaces.

This Technical Report provides an architecture that identifies the key functions of a DQM system and the external functions on which it depends and to which it delivers its output. The requirements for each functional block are given. Interfaces between the functional blocks and between the functional blocks and the external functions are identified. Existing standards that are relevant to these interfaces are indicated and the need for new standardized interfaces identified. Requirements on the interfaces are listed.

[TR-198](#) encompasses:

- definition of the functional architecture of a DQM system
- high level description of the interfaces of a DQM system
- detailed specification of the functional and performance requirements for the Northbound
- interface of the Data Collection Function within a DQM system
- requirements for the Southbound interface for the Data Collection Function within a
- DQM system
- specification of the performance requirements for the DQM-ME of a Network Element
- within a DQM system
- high level description and requirements of other functions within a DQM system

[TR-198](#) is focused on DSL technologies that are currently addressed by G.997.1 [18]. Extension to SHDSL is for further study.

[TR-252 xDSL Protocol-Independent Management Model](#)

This document specifies a protocol-independent management model for ADSL, ADSL2, ADSL2plus and VDSL2 based on the parameters described in the ITU-T Recommendation G.997.1 “Physical layer management for Digital Subscriber Line (DSL) Transceivers”. The model is based on an earlier model specified in Broadband Forum TR-129 with the configuration part of the model replaced by the Vector of Profiles (VoP) model specified in TR-165 and the extension of the model to include new parameters defined in a more recent version of G.997.1. In VoP the configuration parameters are divided into independent sets or profiles which are addressed by a vector of pointers.

This Technical Report places into an object model all the parameters specified in G.997.1 for:

- Configuration Management
- Status Monitoring
- Performance Management including thresholds
- Test / Diagnostics
- Inventory data.

[TR-138 Accuracy Tests for Test Parameters](#)

This Technical Report focuses on loop qualification, loop troubleshooting and in gathering accurate network statistics and related network optimization. Service Providers rely on these functionalities in network operations and management, for which the ADSL and VDSL2 test parameters are the underlying source of information. The key values of this Technical Report also allow the consumer to benefit by enabling efficient DSL service installation, and better service optimization and troubleshooting.

On one hand, this information derived from the test parameters is useful only if these test parameters are reported by DSL equipment with sufficient accuracy. On the other hand, it is important for silicon and equipment vendors that the required accuracy is also feasible within reasonable implementation complexity. It is to reflect the industry consensus on this key tradeoff, that the Broadband Forum has released this Technical Report. This Technical Report provides test setup, methodology and expected results, as to determine whether or not the accuracy requirements defined in ITU-T Recommendations are met.

This Technical Report accompanies TR-100 (ADSL2/ADSL2plus interoperability test plan) and TR-114 (VDSL2 interoperability test plan). Where these Broadband Forum deliverables define rate/reach performance requirements under various loop and noise conditions, this Technical Report TR-138 defines the tests for verification of actual accuracy provided by implementations, in reporting loop and noise characteristics, against the accuracy requirements defined in the ITU-T DSL Recommendations. The ITU-T DSL Recommendations G.992.3 (ADSL2 transceivers), G.992.5 (ADSL2plus transceivers) and G.993.2 (VDSL2 transceivers) define several test parameters that are reported by the transceivers to the management system as defined in G.997.1 (Physical Layer OAM).

The test parameters covered in this Technical Report represent the subset of the transceiver test parameters from G.997.1 that both have accuracy requirements defined in G.992.3, G.992.5 and G.993.2 and which have been identified by the Broadband Forum as being of special importance in DSL testing and operations support.

[TR-160 IPTV Performance Monitoring](#)

As mentioned in the DQM section, IPTV services carried over the broadband access network require a particular level of Quality of Service (QoS) to support adequate Quality of Experience (QoE). Emerging networks have the capability to deliver a specified QoS but in some circumstances QoS may deteriorate

such that, although the IPTV service continues to work, there would be an unacceptable customer experience. In more severe cases, network issues lead to a complete disruption of service.

[TR-160](#) addresses IPTV Performance Monitoring from the Broadband Network Gateway (BNG) to the Set Top Box (STB) assuming a BroadbandSuite™ 3.0 Network Architecture. It describes a comprehensive set of performance indicators and how these can be derived from measurements in the network elements. An overview of the management infrastructure required to provide performance monitoring for end-to-end Quality of Service and demarcation is given and the use of resource performance data discussed.

[TR-160](#) identifies mechanisms for monitoring QoE and demarcating performance issues from the BNG to the STB to one of three network regions:

- Within the Access Network
- Within the Regional Broadband Network or in the Application Service Provider domain
- Customer Premise

[TR-105 Issue 1 Corrigendum 2](#) [ADSL2/2plus Functionality Test Plan](#)

This test plan facilitates ADSL2/2plus over POTS and ISDN functional testing. Its key value is in the verification of transceiver functionalities and management parameters such that network operators may deploy interoperable and successful ADSL2/ADSL2plus services in their networks. This test plan embodies operators' definitions of ADSL2/ADSL2plus interoperability (between one ATU-C and one ATU-R at a time). This test plan defines tests for various physical layer functionalities. A pass/fail indication result is provided for the each functionality tested.

Specifically TR-105 provides a set of test methods to verify a significant subset of the transceiver functional requirements of ADSL2/ADSL2plus modems implemented in accordance with ITU-T G.992.3 “Asymmetric digital subscriber line transceivers 2 (ADSL2)” and ITU-T G.992.5 “Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)” as well as physical layer OAM configuration and performance monitoring parameters defined in ITU-T G.997.1.

TR-105 accompanies TR-100 “ADSL2/ADSL2plus Performance Test Plan” and TR-138 “Accuracy Tests for Test Parameters”. TR-100 provides a set of region specific performance requirements and test methods for ADSL2/ADSL2plus modems implemented in accordance with ITU-T G.992.3 and G.992.5. TR-138 defines the tests for verification of the accuracy of the reported test (Physical Layer OAM configuration and performance monitoring) parameters defined in ITU T G.992.3, G.992.5 and G.997.1.

[TR-127 Issue 2](#) [Dynamic Testing of Splitters and In-Line Filters with xDSL Transceivers](#)

This Technical Report enables high quality delivery of triple play services by maximizing the interoperability of splitters and in-line filters with xDSL transceivers in an active, dynamic, telephony environment including on-hook, off-hook, ringing, and ring trip events. This Technical Report relates to TR-100 (ADSL2/ADSL2plus Performance Test Plan). Compiling the xDSL Splitter requirements with relation to POTS signals and the delivery of IPTV services requires a more complex modeling of the actual POTS signals. This includes the dynamic behavior of the POTS signals, their power and the impedances via which the signals and their power are applied to the xDSL splitters.

TR-127 establishes a methodology for verification of a baseline performance of a system without splitters as device under test (DUT). The system includes, but is not limited to, a complete end-to-end setup using Central Office splitters and remote splitters or in-line filters, xTU modem baseline devices, POTS Central Office AC and DC terminations (including battery and ring-generator) and a telephone model. Dynamic testing of a splitter is performed in a live POTS and xDSL modem environment.

Performance of the system is measured by evaluating the Layer 1 primitives reported by the xTUs (CRCs, FECs, etc.):

- In steady state during on-hook and off-hook
- In the presence of transients, caused by cadenced ringing, and by off-hook or on-hook transitions of phones.
 - Off-hook transitions include ring trip events, i.e. on-hook to off-hook transitions during ringing.

TR-127 Issue 2 was created in co-operation with ETSI Technical Committee ATTM-TM6.

[MR-239](#) **White Paper: Broadband Forum Value Proposition for Connected Home**

The Connected Home space is quickly becoming a major opportunity and focal point of Service Providers' interest to offer additional revenue-generating value-added services to consumers. MR-239 outlines the value proposition the Broadband Forum brings to Service Providers and consumers to enable the next generation family of value-added managed services for the Connected Home, such as Home Monitoring, Control, Security, Media, Health, Energy management, and others via its evolving set of recently updated Technical Report TR-069 standard enhancements, including Software Module Management, ACS Northbound Interface Requirements and future enhancements such as management of non-TR-069 Devices and others.

The purpose of this White Paper is to outline the emerging Connected Home market and the value proposition of Broadband Forum for Service Providers and consumers.

[MR-239](#) describes the Connected Home today and where it is evolving. The paper looks at:

- State of the Connected Home market
- Market potential for the Connected Home services
- Value proposition of the Broadband Forum in the Connected Home
- Examples of managed Connected Home services
- Managed devices and why they matter for deployment
- BBF standards that help efficient and profitable deployment of Connected Home services.

Still in development

There is quite a bit of work in current development that will build on this release. This pending work is available only to the members until released as approved Technical or Marketing Reports, and includes:

- [MD-180](#) White Paper: IPTV over DSL Anywhere
- [PD-199](#) Alias based addressing
- [PD-232](#) Bulk management
- [MD-261](#) White Paper: IPTV Home Networking Series: Splitters
- [WT-249](#) Testing of G.993.5 Self-FEXT Cancellation (Vectoring) for use with VDSL2 transceivers
- [WT-260](#) DCF functional and performance Test Plan
- [MD-257](#) White paper: Vectoring

There are also many enhancements that will be made to current specifications to keep pace with market changes and requirements. We encourage you to download any of the mentioned Broadband Forum Technical Reports and White Papers for free at www.broadband-forum.org.