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BroadbandSuite 3.0 Companion Guide

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Executive Summary

This companion guide provides an overview of the recent release of BroadbandSuite 3.0, and explains the significance of this new set of specifications which were developed to help service providers expand broadband deployment on GPON as well as those active or considering IPTV deployments. This guide also presents a forward looking roadmap for the significant standardization solutions that have been planned for the next two to three years at the Broadband Forum.

For those who are new to the BroadbandSuite release program, Section "Program Goals" provides the background of this 2007 initiative, while Sections 1-2 provide a brief refresher of BroadbandSuite 1.0 and 2.0. Those already familiar with those two releases, can skip forward to Section 3-4 for what's new in Release 3.0. It is important to note that all releases build on the previous releases.

Section 5 provides the roadmap of the Releases in the works. While the exact dates and contents for the future releases are subject to change, this section provides a general indication of the areas of work that is ongoing, and some idea of when to expect certain areas of interest will take place.

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Program Goals

Over the years, the Broadband Forum forged industry best practices and standards that moved DSL into the #1 broadband spot in the world. Maturing from defining basic physical layer transport parameters to optimizing multimedia service delivery across broadband, the Forum's work continues to evolve and to be aligned with real world broadband development and service provider requirements. Work extended to access agnostic architecture and remote management specifications and now a significant amount of work focuses specifically on fiber network solutions.

But how can a service provider know which report to use, or which of the specifications work together to deliver an end-to-end solution? To answer that question, the Broadband Forum began in 2007 to offer our technical reports structured into formal BroadbandSuite™ Releases. Each release builds on the foundation of the past releases, and provides a roadmap for broadband optimization.

With the release of BroadbandSuite 3.0 (11/2008), the Forum expands the library of solution sets again, addressing the evolving architecture and how to support increasingly advanced and bandwidth intensive applications. The releases to date are:

➢ **BroadbandSuite 1.0**, providing the basics for ATM based ADSL and SHDSL deployment and internet access for voice and data. This release introduces the Customer WAN Management Protocol (CWMP) to facilitate remote management of the digital home or office.

➢ **BroadbandSuite 2.0** moved the network from ATM to IP-Ethernet, and the local loop to include ADSL2plus- a faster option that better suits high bandwidth applications such as IPTV. Release 2.0 also brings in more sophisticated remote management beyond the gateway to identify, provision and manage the various online devices effectively.

➢ *New!* **BroadbandSuite 3.0** takes another step forward by introducing fiber specifications into the IP based network and by strengthening the IPTV deployment and management model to promote better Quality of customer Experience (QoE).

This paper sets out to provide a brief overview of the Release Program from inception through the finalizing of BroadbandSuite 3.0. It also provides a portal into the next areas of work with BroadbandSuite 3.1 and beyond.

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1   BroadbandSuite 1.0

The following Broadband Forum documents are part of the BroadbandSuite 1.0

Table 1-1 BroadbandSuite 1.0

NETWORK R1.0	USER R1.0	MANAGEMENT R1.0
TR-013 : Interface & Configurations for ADSL Central Office	TR-061 : Interfaces and System Configurations for ADSL: Customer Premises	TR-024 : DMT Line Code Specific MIB
TR-025 : Core Network Architecture for Access to Legacy Data Network over ADSL	TR-062 : Auto-Config for the Connection Between the B-NT and the Network using ATM	TR-027 : SNMP-based ADSL LINE MIB
TR-042 : ATM Transport over ADSL Recommendation	TR-064 : LAN-Side DSL CPE Configuration Specification	TR-050 : CORBA v2 for ADSL EMS-NMS Interface
TR-043 : Protocols at the U Interface for Accessing Data Networks using ATM/DSL	TR-068 Issue 2 : Base Requirements for an ADSL Modem with Routing	TR-051 : DSL Specific Conventions for the ITU-T Q.822.1 Performance Mgmt Bulk Data File Structure
TR-059 : Architecture Requirements for the Support of QoS-Enabled IP Services	TR-069 : CPE WAN Mgmt Protocol	TR-066 : ADSL Network Element Mgmt
TR-060 : Interop Test Plan for SHDSL	TR-098 : Gateway Device Version 1.1 Data Model for TR-069	TR-090 : Protocol Independent Object Model for Managing Next Generation ADSL Technologies
TR-067 : ADSL Interop Test Plan	TR-104 : Provisioning Parameters for VoIP CPE	
TR-092 : Broadband Remote Access Server (BRAS) Requirements Document	TR-111 : Applying TR-069 to Remote Management of Home Networking Devices	
	TR-133 : TR-064 Extensions for Service Differentiation	

Key Capabilities: **Internet Access via ADSL or SHDSL over a QoS-enabled ATM architecture which supports Voice over IP and Video on Demand**

2   BroadbandSuite 2.0

The following Broadband Forum documents are part of the BroadbandSuite 2.0

Table 2-1 BroadbandSuite 2.0

NETWORK R2.0	USER R2.0	MANAGEMENT R2.0
TR-101 : Migration to Ethernet Based DSL Aggregation	TR-124 : Functional Requirements for Broadband Residential Gateway Devices	TR-130 : xDSL EMS to NMS Interface Functional Requirements
TR-100 : ADSL2/2plus performance test plan	TR-069 Amendment 1 : CPE WAN Management Protocol	TR-129 : Protocol-Independent Management Model for Next Generation DSL Technologies
TR-067 Issue 2 : ADSL Interoperability Test Plan	TR-098 Amendment 1 : Internet Gateway Device Data Model for TR-069	TR-128 : Addendum to TR-090, Protocol Independent Object Model for Managing Next Generation ADSL Technologies
	TR-122 : Base Requirements for Consumer-Oriented Analog Terminal Adapter Functionality	
	TR-068 Issue 3: Base Requirements for an ADSL Modem with Routing	

Key Capabilities: Triple-play access via ADSL2plus over a QoS-enabled Ethernet architecture.   Provides full support for multicast to enable IPTV streaming.
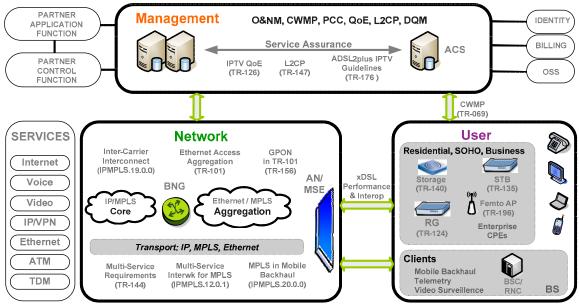
3   *Latest Release!* BroadbandSuite 3.0

Figure 3-1 BroadbandSuite 3.0

BroadbandSuite 3.0 adds considerable new capabilities and specifications to enhance today's fiber integration and IPTV rollouts. Specifically, the benefits include:

Optimizes IPTV performance
  ➢ Reliable ADSL2plus profiles guarantee a good user's QoE
  ➢ CPE object models simplifies customer experience, and improves the service provider's bottom line
  ➢ Better troubleshooting techniques facilitate proactive maintenance and responsive customer service

Allows providers to seamlessly integrate fiber and bonded DSL options into their current network architecture and management procedures
  ➢ Faster options
  ➢ Efficient management
  ➢ Single architecture

Simplifies management of the latest devices coming into the home- STB, storage devices and PON devices
  ➢ Devices are easily recognized/provisioned by the TR-069 adherent ACS
  ➢ Easily managed and updated remotely as well

Overall, BroadbandSuite 3.0 provides a roadmap to ensure Quality of customer Experience (QoE) in today's multimedia environment.

Table 3-1 BroadbandSuite 3.0

NETWORK R3.0	USER R3.0	MANAGEMENT R3.0
TR-156: Using GPON Access in the Context of TR-101	TR-135: Data Model for a TR-069 Enabled Set Top Box	TR-117: Broadband Trouble Reporting
	TR-140: TR-069 Data Model for Storage Service Enabled Devices	TR-141: Protocol Independent Management Model for Access Nodes Supporting TR-101
	TR-142: Framework for TR-069 Enabled PON Devices	TR-176: ADSL2Plus Configuration Guidelines for IPTV
	TR-143: Enabling Network Throughput Performance Test and Statistical Monitoring	TR-147: Layer 2 Control Mechanism
	TR-098 Amendment 2: Internet Gateway Device Data Model for TR-069	TR-159: Management Framework for xDSL Bonding
	TR-106 Amendment 2: Data Model Template for TR-069 Enabled Devices	TR-169: EMS-NMS Interface Reqs for Access Nodes Supporting TR-101

Technical Capabilities: Triple-play access augmented via GPON or bonded DSL over a QoS-enabled Ethernet architecture. This provides full support for multicast to enable IPTV streaming. Allows integrated remote management of Set-Top Box & attached storage devices.

4   Section Overviews

4.1   Access and Architecture Related Work

4.1.1   TR-156: Using GPON Access in the Context of TR-101

In April of 2006, "Migration to Ethernet Access Aggregation" TR-101 provided the roadmap for moving from ATM access aggregation to an Ethernet-based architecture that has become a global standard for triple-play deployments for residential and business customers that use DSL as the broadband access technology. However, many of TR-101's architecture specifications are access agnostic, and they are also being widely used today with other access technologies, especially FTTx / PON.

Eagerly awaited "Using GPON Access in the Context of TR-101" Technical Report 156 (TR-156) strengthens the TR-101 requirements as applied to GPON by providing more detailed and specific requirements. In order to reduce operational complexity and maximize equipment interoperability, a subset of the GPON's flexible configuration arrangements are specified here to facilitate the implementation of TR-101's VLAN architecture options. Other parts of this specification enable providers to take full advantage of GPON's abilities, and to ensure a more seamless integration of GPON into traditional broadband networks.

4.2   BroadbandHome Related Work

4.2.1   Data Models

4.2.1.1   TR-106 Amendment 2: Data Model Template for TR-069 Enabled Devices

This Technical Report specifies data model guidelines to be followed by all TR-069 capable devices. These guidelines include structural requirements for the data hierarchy, requirements for versioning of data models, requirements for defining profiles, a set of common data objects, and a baseline profile for any device supporting these common data objects. In addition, this Technical Report defines an XML Schema that as far as possible embodies these guidelines, and which is to be used for defining TR-069 data models.

4.2.1.2   TR-098 Amendment 2: Internet Gateway Device Data Model for TR-069

This Technical Report describes the Internet Gateway Device data model for the CPE WAN Management Protocol (CWMP). It is intended to support a variety of different functionalities to manage a collection of CPE, including the following primary capabilities:
   ➢ Auto-configuration and dynamic service provisioning
   ➢ Software/firmware image management
   ➢ Status and performance monitoring
   ➢ Diagnostics

The ability to manage the home network remotely has a number of benefits including reducing the costs associated with activation and support of broadband services, improving time-to-market for new products and services, and improving the user experience.

If TR-069 defines the generic methods for any device, this Technical Report (similar to all data models) specifies the managed Internet Gateway Device parameters on which the generic methods act to configure, diagnose, and monitor the state of specific devices and services.

4.2.1.3   TR-135: Data Model for a TR-069 Enabled Set Top Box

This Technical Report defines the data model for remote management of Digital Television (IPTV or broadcast) functionality on Set Top Box (STB) devices via CWMP as defined in TR-069 and TR-106. It covers the data model for describing a STB device as well as provides rules regarding notifications on parameter value change. General use cases are also included, such as standard data model profiles that would typically be seen while remotely managing a device of this nature.

In the specifications, access to network and PVR content is managed by a (proprietary) IPTV Service Platform. The ACS may perform some initial configuration of a newly installed STB, but its main functions are configuration of STB parameters for trouble management and collection of statistics for QoS/QoE monitoring.

4.2.1.4   TR-140: TR-069 Data Model for Storage Service Enabled Devices

This Technical Report defines the data model for the remote management of Storage Service devices via CWMP as defined in TR-069 and TR-106. It covers the data model for describing a Storage Service device as well as rules regarding notifications on parameter value change. General use cases are also included, describing standard data model profiles that would typically be seen while remotely managing a device of this nature.

4.2.1.5   TR-142: Framework for TR-069 Enabled PON Devices

This Technical Report defines a framework for remote management of Optical Network Termination (ONT) devices with IP-based services over PON and fiber access technology. TR-069 is the protocol of choice for the remote management and configuration of IP services over PON and fiber access networks. TR-069 is intended to be used for the remote configuration and management of IP services running over ONT, as well as for some aspects of ONT management. The scope of this Technical Report is limited to the remote auto-configuration and management of ONTs with integrated IP-based services. The scope of this Technical Report does not address OLT, ONU, pure Layer 2 ONT or the management of any remote units in the access network.

4.2.2   Performance Testing

4.2.2.1 TR-143: Enabling Network Throughput Performance Tests and Statistical Monitoring

This Technical Report defines the CPE data model objects for Network Service Providers to initiate performance throughput tests and monitor data on the IP interface of a CPE using the Diagnostic mechanism defined in TR-069 Amendment 2 [1].

The Network Service Provider provides network infrastructure and services to its customers, such as Content Service Providers who source the information and end users who consume the information. In order to minimize the downtime of network services, this performance test mechanism gives the Network Service Provider the tools needed to monitor the performance of the network continuously and diagnose problems real time.

The architecture of TR-069 Amendment 2 [1] enables device management with the CPE devices both at the customer's gateway, and with devices within the customer's home network. The diagnostic and monitoring objects provided with this Technical Report will assist the Network Service Provider in determining whether the problem occurs in the Network Service Provider's network or the customer's home network.

4.3   Network Management and Policy Control Related Work

4.3.1   Operational Tools

4.3.1.1   TR-117: Broadband Trouble Reporting

This Technical Report defines a common way to define and exchange DSL trouble information between service providers. It facilitates cooperative service restoration through agreement on a framework for DSL Fault Management that includes consistent criteria for trouble declaration, definition of trouble types, and definition of trouble attributes. This also provides both a method of exchanging trouble information and guidelines for declaring troubles so that service providers can exchange reliable and complete trouble information.

4.3.1.2   TR-176: ADSL2plus Configuration Guidelines for IPTV

This Technical Report contains recommended ADSL2plus profile parameter settings for use in the deployment of IPTV over ADSL2plus. The parameter values were derived from the experiences of service providers and vendors who have already tested, trialed and/or deployed IPTV over ADSL2plus and hence represent current industry best practice.

4.3.2   Access Node Management & Control Specification

4.3.2.1   TR-141: Protocol Independent Management Model for Access Nodes Supporting TR-101

This Broadband Forum Technical Report provides the Element Management System's (EMS) interpretation of requirements included in Broadband Forum Technical Report TR-101 that are applicable for managing an Access Node (AN). The Technical Report indicates

the managed objects derived from TR-101, arranged according to their association with logical managed entities. The Technical Report is protocol independent, which means it does not refer to any particular management protocol between the EMS and the AN.

4.3.2.2   TR-169: EMS-NMS Interface Reqs for Access Nodes Supporting TR-101

The purpose of this Technical Report is to provide high level functional requirements describing an interface from an Element Management System (EMS) to a Network Management System (NMS) in support of DSL migration to Ethernet. This Working Text leverages the ATM aggregation to Ethernet requirements defined in TR-101, the TR-141 Network Element (NE)-EMS information model, the DSL EMS-NMS interface requirements defined in TR-130, and the ITU-T Rec. Q.840.1 EMS-NMS information model requirements and terminology to produce a set of Ethernet aggregation requirements that is consistent with the direction of international standards.

4.3.2.3   TR-147: Layer 2 Control Mechanism

When deploying value-added services across broadband access networks, special attention regarding Quality of Service and service control is required. This implies a tight coordination between network nodes, notably Access Nodes (e.g. a Digital Subscriber Line Access Multiplexer (DSLAM) and Broadband Network Gateways (BNG). Coordination between these network nodes could be performed by means of interworking via the management plane. However, this is not always possible because of organizational boundaries between business entities operating the local loop, the aggregation network and the IP network. Further, management networks are usually not designed to transmit management data between the different entities in real time.

Therefore, there is a need for a Layer 2 Control Mechanism that runs directly between a BNG and an Access Node, in order to perform Quality of Service (QoS) related, service-related and subscriber-related operations, using direct device-to-device communication. This allows access link related operations to be performed within those network elements, while avoiding any impact on the existing management systems.

TR-147 provides a framework for the Layer 2 Control Mechanism and identifies a number of use cases for which this mechanism may be appropriate. It then presents the requirements for the Layer 2 Control Mechanism and the network elements that are needed to support it, ensuring tailored quality assessment and delivery.

4.3.2.4   TR-159: Management Framework for xDSL Bonding

Bonding enables a Service Provider to provide xDSL service over longer loops or to provide higher bandwidths over existing loops, which is an important and potentially economical option for multi-service or IPTV support.

The Broadband Forum's "Management Framework for xDSL Bonding" Technical Report 159 (TR-159) provides a management framework for xDSL bonding specified in:
   ➢ ITU-T recommendations G.998.1 (ATM-based multi-pair bonding),

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> ➢ G.998.2 (Ethernet-based multi-pair bonding) and
> ➢ G.998.3 (Multi-pair bonding using time division inverse multiplexing).

The ITU-T Recommendations do not specify the management of bonding. To address this issue, the Broadband Forum provides TR-159, which defines the required managed objects in a protocol independent manner, which means it does not refer to any particular management protocol between the Element Management System (EMS) and the Network Element (NE). The management framework facilitates the deployment of bonded xDSL by enabling bonding to be configured and monitored in a standardized way.

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5   Next Steps

Beyond Broadband Release 3.0, additional releases and sub-releases are planned according to strategic and technical focuses determined collectively by the Broadband Forum. However, this forward looking information serves only as a guideline. The releases and the content of each release may change as technologies and industry priorities shift.

The first sub-release expected is BroadbandSuite 3.1 which is detailed below. Additional BroadbandSuite 3.x sub-releases are expected to address new TR-069 object models, IPTV Best Practices and Use Cases, additional fiber related access solutions and DSL Quality Management. The timeline for these is not confirmed, but the work has begun on all.

Table 5-1 BroadbandSuite 3.1

NETWORK R3.1	USER R3.1	MANAGEMENT R3.1
WT-114 : VDSL2 performance Test plan	TR-157 Amendment 1: Supported Data Model Table	TR-165 Vector of Profiles
WT-115 : VDSL2 Functionality Test Plan	TR-196: Femto Access Point Data Model	
TR-127 : Dynamic Testing of DSL Transceivers with Splitters	TR-106 Amendment 3: CWMP Data Model Schema (adding use cases)	

5.1   BroadbandSuite 3.1 Technical Capabilities:

5.1.1   Network related specifications

- ➢ Establishes an industry agreed test suite, specifying common, global VDSL2 equipment testing methods and requirements assuring good performance and equipment interoperability to facilitate the use of equipment from multiple vendors.
- ➢ Offers whole house splitter specifications that enhance IPTV delivery and ensure consistent customer satisfaction

5.1.2   User related specifications

- ➢ Extends TR-069 provisioning and maintenance to ensure quality Femto cell service and coverage
- ➢ Provides the framework to continue building recognizable object models for emerging online devices- adding to the family of products and services easily managed via TR-069
- ➢ Establishes TR-069 use cases, expediting this management platform adoption

5.1.3   Network Management related specifications

➢ Defines a Vector of Profiles (VoP) based object model for DSL configuration that allows for great flexibility of configuration without an undue burden of data storage in DSL Element Managers or DSLAMs. This is particularly important for FTTx deployment scenarios.

➢ Helps service providers implement efficient and cost effective network operation processes such as network creation, service delivery, service assurance and troubleshooting.

6   Beyond BroadbandSuite 3.1

Moving forward beyond BroadbandSuite 3.x, the Forum will continue to address the most pressing needs of the industry. In the funnel of work, we anticipate major releases focused on IPv6 transition, and converged network and multi-service architecture. Specifications on energy efficiency, fixed mobile convergence and G.hn home networking are also in development.

Covering more than 300 technical contributions from members at each of its quarterly meetings, the Forum continues to be a catalyst of broadband innovation and progress. For more information and to get involved, visit www.broadband-forum.org.

End of Broadband Forum Marketing Report MR-186