TR-157
Component Objects for CWMP

Issue 1 Amendment 2
Issue Date: May 2010

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Issue History

Issue Number	Issue Date	Issue Editor	Changes
Issue 1	March 2009	John Blackford, 2Wire, Inc. TimSpets, Westell	Original
Issue 1 Amendment 1	September 2009	John Blackford, 2Wire, Inc.	Addition of SupportedDataModel component.
Issue 1 Amendment 2	May 2010	John Blackford, 2Wire, Inc.	Support for TR-181 Issue 2.

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Executive Summary

The architecture of TR-069 Amendment 2 [1] and TR-106 Amendment 3 [2] enables device management of CPE devices in the customer's home, including the home gateway, and devices behind it.

This Technical Report defines additional management objects for use in CWMP managed devices. The objects may exist at the top level of a hierarchy, or in some cases within an existing object.   The objects are intended for use in all CWMP root objects (both Device and InternetGatewayDevice). The objects define varying functionality, diagnostics, etc., that are agnostic to the type of device.

The additional management objects defined in this Technical Report include the following:

Enhanced device diagnostic and monitoring capabilities - These enhanced features include the ability to monitor device memory and process status as well as reporting of temperature sensor status and alarms. Two diagnostic tests have also been added: Namespace Lookup and hardware-specific self-test.

Autonomous Transfer and Multi-cast Download Policy Configuration - This specification completes the additions to CWMP undertaken in collaboration with DVB to ensure TR-069's ability to meet the needs of IP video environments. In [1] capabilities for multi-cast download and autonomous transfers were added to the CWMP protocol; in this Technical Report, objects have been added for managing the policies around autonomous transfer reporting and configuring the multicast download availability.

Simple Firewall - Simple firewall management has been defined in this specification.

USB Hosts - This specification contains objects that enable the remote management of USB Hosts and policies for the behavior of attached USB devices.

UPnP and DLNA discovery - UPnP is a widely deployed home networking technology; DLNA digital home servers and digital home players use UPnP technology to provide content streaming and sharing across devices in the home. Objects defined in this specification enable the reporting of UPnP and DLNA devices and capabilities in the home network in order to give service providers increased visibility into the subscriber home.

Periodic Stats - The periodic stats object allows for the collection and reporting of performance monitoring data for TR-069 enabled devices.

Supported Data Model – This table lists all of the Device Type (as defined in TR-106 Amendment 3 [2]) instances that make up the device's entire supported data model and thus allows an ACS to easily discover the device's supported data model.

In summary, these enhancements continue to ensure that CWMP is meeting the management needs of operators' next generation home networking services.

1   Purpose and Scope

1.1   Purpose

The purpose of TR-157 is to provide Component Objects for CWMP.

A Component Object is defined as an object and their contained parameters intended for use in any applicable CWMP root data model (both Device and InternetGatewayDevice). The object(s) may reside at the top level or an appropriate sub-object level.

1.2   Scope

TR-157 defines Component Objects for use in CWMP managed devices for all root data models. The current root data models are InternetGatewayDevice:1 defined in TR-098 Amendment 2 [5], Device:1 defined in TR-181 [3], and Device:2 defined in TR-181 Issue 2 [4].

Sections containing "Theory of Operations" for Component Objects are located in the appendices.

2   References and Terminology

2.1   Conventions

In this Technical Report several words are used to signify the requirements of the specification. These words are often capitalized.

MUST	This word, or the adjective "REQUIRED", means that the definition is an absolute requirement of the specification.
MUST NOT	This phrase means that the definition is an absolute prohibition of the specification.
SHOULD	This word, or the adjective "RECOMMENDED", means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications need to be understood and carefully weighted before choosing a different course.
MAY	This word, or the adjective "OPTIONAL", means that this item is one of an allowed set of alternatives. An implementation that does not include this option MUST be prepared to inter-operate with another implementation that does include the option.

2.2 References

The following references constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Technical Report are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below. A list of currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

[1] TR-069 Amendment 2, *CPE WAN Management Protocol,* Broadband Forum Technical Report, 2007

[2] TR-106 Amendment 3, *Data Model Template for TR-069-Enabled Devices,* Broadband Forum Technical Report, 2009

[3] TR-181, Device Data Model for TR-069, Broadband Forum Technical Report, 2010

[4] TR-181 Issue 2, Device Data Model for TR-069, Broadband Forum Technical Report, 2010

[5] TR-098 Amendment 2, *Internet Gateway Device Data Model for TR-069,* Broadband Forum Technical Report, 2008

[6] DLNA Networked Device Interoperability Guidelines, *DLNA Networked Device Interoperability Guidelines, Volume 2: Media Format Profiles.*, DLNA, October 2006, http://www.dlna.org/industry/certification/guidelines/

[7] TS 102 824, *Digital Video Broadcasting (DVB);Remote Management and Firmware Update System for DVB IP Services*, ETSI, July 2008, http://webapp.etsi.org/workprogram/Report_WorkItem.asp?WKI_ID=27769

[8] ICSA Modular Firewall Certification Criteria, *Required Services Security Policy - Small/Medium Business (SMB) Category module - version 4.0*, ICSA Labs, http://www.icsalabs.com/icsa/docs/html/communities/firewalls/pdf/criteria/SMB.pdf

[9] ISO/IEC 13818-6:1998, *Information Technology - Generic coding of moving pictures and associated audio information - Part 6: Extensions for DSM-CC*, ISO, 1998, http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=25039

[10] Organizationally Unique Identifiers (OUIs), http://standards.ieee.org/faqs/OUI.html

[11] RFC 1323, *TCP Extensions for High Performance*, IETF, May 1992, http://www.ietf.org/rfc/rfc1323.txt

[12] RFC 2581, *TCP Congestion Control*, IETF, April 1999, http://www.ietf.org/rfc/rfc2581.txt

[13] RFC 2582, *The NewReno Modification to TCP's Fast Recovery Algorithm*, IETF, April 1999, http://www.ietf.org/rfc/rfc2582.txt

[14] RFC 2616, *Hypertext Transfer Protocol -- HTTP/1.1*, IETF RFC, June 1999, http://www.ietf.org/rfc/rfc2616.txt

[15] RFC 2818, *HTTP Over TLS*, IETF, May 2000, http://www.ietf.org/rfc/rfc2818.txt

[16] RFC 2974, *Session Announcement Protocol*, IETF, October 2000,
    http://www.ietf.org/rfc/rfc2974.txt

[17] RFC 3066, *Tags for the Identification of Languages*, IETF RFC,
    http://www.ietf.org/rfc/rfc3066.txt

[18] RFC 3926, *FLUTE - File Delivery over Unidirectional Transport*, IETF, October 2004,
    http://www.ietf.org/rfc/rfc3926.txt

[19] RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*, IETF RFC,
    http://www.ietf.org/rfc/rfc3986.txt

[20] RFC 4122, *A Universally Unique IDentifier (UUID) URN Namespace*, IETF RFC, July
    2005, http://www.ietf.org/rfc/rfc4122.txt

[21] RFC 793, *Transmission Control Protocol*, IETF, September 1981,
    http://www.ietf.org/rfc/rfc793.txt

[22] UPnP Device Architecture, *UPnP Device Architecture 1.0*, UPnP Forum, April 2008,
    http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0-20080424.pdf

[23] USB 1.0, *USB 1.0 Specification*, USB-IF, January 1996,
    http://www.usb.org/developers/docs/

[24] USB 2.0, *USB 2.0 Specification*, USB-IF, April 2000,
    http://www.usb.org/developers/docs/usb_20_122208.zip

[25] USB 3.0, *USB 3.0 Specification*, USB-IF, November 2008,
    http://www.usb.org/developers/docs/usb_30_spec.zip

2.3 Definitions

The following terminology is used throughout this Technical Report:

ACS Auto-Configuration Server. This is a component in the broadband network responsible for auto-configuration of the CPE for advanced services.

CPE Customer Premises Equipment; refers to any TR-069-enabled device and therefore covers both Internet Gateway devices and LAN-side end devices.

CWMP CPE WAN Management Protocol. Defined in TR-069 Amendment 2 [1], CWMP is a communication protocol between an ACS and CPE that defines a mechanism for secure auto-configuration of a CPE and other CPE management functions in a common framework.

2.4 Abbreviations

This Technical Report defines the following abbreviations:

CPU Central Processing Unit

DDD Device Description Document

DLNA Digital Living Network Alliance

DNS Domain Name System

GUI Graphical User Interface

HTTP Hypertext Transfer Protocol

HTTPS Hypertext Transfer Protocol over Secure Socket Layer

IGD Internet Gateway Device

LAN Local Area Network

NAT Network Address Translation

QoS Quality of Service

RAM Random Access Memory

SSDP Simple Service Discovery Protocol

TCP Transmission Control Protocol

TR Technical Report

URL Universal Resource Locator

USB Universal Serial Bus

USB-IF USB Implementer's Forum

USN Unique Service Name

UTC Coordinated Universal Time

UUID Universally Unique Identifier

WAN Wide Area Network

WG Working Group

XML Extensible Markup Language

3 Technical Report Impact

3.1 Energy Efficiency

TR-157 has no impact on energy efficiency.

3.2 IPv6

TR-157 has no impact on IPv6 support and compatibility.

3.3 Security

There are no relevant security issues relating to TR-157.

4   Device:1 Parameter Definitions

The normative definition of the Device:1 data model is split between several DM Instance documents (see TR-069 [1] Annex A). Table 1 lists the data model versions and DM Instances that had been defined at the time of writing. It also indicates the corresponding Technical Reports and gives links to the associated XML and HTML files.

Note that, because new minor versions of the Device:1 data model can be defined without re-publishing this Technical Report, the table is not necessarily up-to-date. An up-to-date version of the table can always be found at http://www.broadband-forum.org/cwmp.

Table 1 – Device:1 Data Model Versions

Version	DM Instance	Technical Report	XML and HTML[1]
1.0	tr-106-1-0.xml	TR-106	http://broadband-forum.org/cwmp/tr-106-1-0.xml
			http://broadband-forum.org/cwmp/tr-106-1-0.html
1.1	tr-106-1-1.xml	TR-106 Amendment 1	http://broadband-forum.org/cwmp/tr-106-1-1.xml
			http://broadband-forum.org/cwmp/tr-106-1-1.html
			http://broadband-forum.org/cwmp/tr-106-1-1-last.html
1.2	tr-143-1-0.xml	TR-143	http://broadband-forum.org/cwmp/tr-143-1-0.xml
			http://broadband-forum.org/cwmp/tr-143-1-0-dev.html
			http://broadband-forum.org/cwmp/tr-143-1-0-dev-last.html
	tr-106-1-2.xml	TR-106 Amendment 2	http://broadband-forum.org/cwmp/tr-106-1-2.xml
			http://broadband-forum.org/cwmp/tr-106-1-2.html
			http://broadband-forum.org/cwmp/tr-106-1-2-last.html
1.3	tr-157-1-0.xml	TR-157	http://broadband-forum.org/cwmp/tr-157-1-0.xml
			http://broadband-forum.org/cwmp/tr-157-1-0-dev.html
			http://broadband-forum.org/cwmp/tr-157-1-0-dev-last.html
1.4	tr-157-1-1.xml	TR-157 Amendment 1	http://broadband-forum.org/cwmp/tr-157-1-1.xml
			http://broadband-forum.org/cwmp/tr-157-1-1-dev.html
			http://broadband-forum.org/cwmp/tr-157-1-1-dev-last.html
1.5	tr-181-1-0.xml	TR-181 Issue 1	http://broadband-forum.org/cwmp/tr-181-1-0.xml
			http://broadband-forum.org/cwmp/tr-181-1-0.html
			http://broadband-forum.org/cwmp/tr-181-1-0-last.html
1.6	tr-157-1-2.xml	TR-157 Amendment 2	http://broadband-forum.org/cwmp/tr-157-1-2.xml
			http://broadband-forum.org/cwmp/tr-157-1-2-dev.html
			http://broadband-forum.org/cwmp/tr-157-1-2-dev-last.html

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[1]   The HTML with a name of the form tr-xxx-i-a.html, e.g. tr-181-1-0.html, lists the entire data model. The HTML with a name of the form tr-xxx-i-a-dev.html, e.g. tr-157-1-0-dev.html, lists only the Device Root Object (not the InternetGatewayDevice Root Object). The HTML with a name of the form tr-xxx-i-a-last.html, e.g. tr-181-1-0-last.html, lists only the changes since the previous version. "dev" and "last" can be combined, e.g. tr-157-1-0-dev-last.html.

5   InternetGatewayDevice:1 Parameter Definitions

The normative definition of the InternetGatewayDevice:1 data model is split between several DM Instance documents (see TR-069 [1] Annex A). Table 2 lists the data model versions and DM Instances that had been defined at the time of writing. It also indicates the corresponding Technical Reports and gives links to the associated XML and HTML files.

Note that, because new minor versions of the InternetGatewayDevice:1 data model can be defined without re-publishing this Technical Report, the table is not necessarily up-to-date. An up-to-date version of the table can always be found at http://www.broadband-forum.org/cwmp.

Table 2 – InternetGatewayDevice:1 Data Model Versions

Version	DM Instance	Technical Report	XML and HTML[2]
1.0	tr-069-1-0.xml	TR-069	http://broadband-forum.org/cwmp/tr-069-1-0.xml
			http://broadband-forum.org/cwmp/tr-069-1-0.html
1.1	tr-098-1-0.xml	TR-098	http://broadband-forum.org/cwmp/tr-106-1-1.xml
			http://broadband-forum.org/cwmp/tr-106-1-1.html
			http://broadband-forum.org/cwmp/tr-106-1-1-last.html
1.2	tr-098-1-1.xml	TR-098 Amendment 1	http://broadband-forum.org/cwmp/tr-098-1-1.xml
			http://broadband-forum.org/cwmp/tr-098-1-1.html
			http://broadband-forum.org/cwmp/tr-098-1-1-last.html
1.3	tr-143-1-0.xml	TR-143	http://broadband-forum.org/cwmp/tr-143-1-0.xml
			http://broadband-forum.org/cwmp/tr-143-1-0-igd.html
			http://broadband-forum.org/cwmp/tr-143-1-0-igd-last.html
1.4	tr-098-1-2.xml	TR-098 Amendment 2	http://broadband-forum.org/cwmp/tr-098-1-2.xml
			http://broadband-forum.org/cwmp/tr-098-1-2.html
			http://broadband-forum.org/cwmp/tr-098-1-2-last.html
1.5	tr-157-1-0.xml	TR-157	http://broadband-forum.org/cwmp/tr-157-1-0.xml
			http://broadband-forum.org/cwmp/tr-157-1-0-igd.html
			http://broadband-forum.org/cwmp/tr-157-1-0-igd-last.html
1.6	tr-157-1-1.xml	TR-157 Amendment 1	http://broadband-forum.org/cwmp/tr-157-1-1.xml
			http://broadband-forum.org/cwmp/tr-157-1-1-igd.html
			http://broadband-forum.org/cwmp/tr-157-1-1-igd-last.html
1.7	tr-157-1-2.xml	TR-157 Amendment 2	http://broadband-forum.org/cwmp/tr-157-1-2.xml
			http://broadband-forum.org/cwmp/tr-157-1-2-igd.html
			http://broadband-forum.org/cwmp/tr-157-1-2-igd-last.html

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[2]   The HTML with a name of the form tr-xxx-i-a.html, e.g. tr-181-1-0.html, lists the entire data model. The HTML with a name of the form tr-xxx-i-a-igd.html, e.g. tr-157-1-0-igd.html, lists only the InternetGatewayDevice Root Object (not the Device Root Object). The HTML with a name of the form tr-xxx-i-a-last.html, e.g. tr-181-1-0-last.html, lists only the changes since the previous version. "igd" and "last" can be combined, e.g. tr-157-1-0-igd-last.html.

Appendix I.   USB Host Theory of Operation

An increasing number of devices are equipped with a USB Host controller and USB host interface(s) / connector(s) (series A receptacle).

There are a number of use cases for adding a USB Host and connected devices to a CWMP data model. One example is retrieving the exact product identity of the connected device in the event of service issues such as printer or file sharing problems. Another example is notifying the user that a newly-connected device is not supported, e.g. due to a missing driver. Or the detection of the connection of a particular USB device could mean additional services for this device could be offered to the subscriber.

The data model contains the number of devices connected to each host controller. For each device, the main properties of the USB device descriptors as well as interface descriptors are represented. The latter is to support devices that only indicate class/subclass (and therefore device type) at the interface level.

Example USB topology of connected devices:
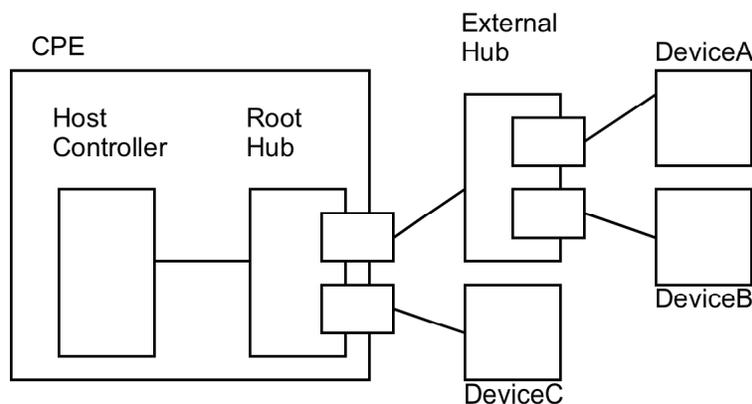
Figure 1 - Example USB Host Connections

All USB devices attach to a USB Host through a port on a USB entity known as a hub. Hubs have status bits that are used to report the attachment or removal of a USB device on one of its ports. The USB Host queries the hub to retrieve these status bits. In the case of an attachment, the USB Host enables the port and addresses the USB device through the device's control pipe at

the default address.   Figure 1 depicts both a Root Hub and an External Hub that provide this service.

The USB Host assigns a unique USB address to the device and then determines if the newly attached USB device is a hub or function. The USB Host establishes its end of the control pipe for the USB using the assigned USB address and endpoint number zero. This is reflected in the data model by adding a new USBHosts.Host.{i}.Device.{i}. instance.

If the attached USB device is a hub and USB devices are attached to its ports, then the above procedure is followed for each of the attached USB devices.

If the attached USB device is a function, then attachment notifications will be handled by the USB Host software that is appropriate for the function.

End of Broadband Forum Technical Report TR-157