TR-142

Framework for TR-069 enabled PON devices

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Issue History

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Summary

This document describes how an ACS can remotely configure, troubleshoot, and manage a PON ONT with layer 3 capabilities using TR-069.

1   Purpose

This document goal is to provide a framework for the remote configuration and management of services for PON (Passive Optical Network) access and fiber access. .

2   Scope

This document is intended to define a framework for remote management of ONT 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 document is limited to the remote auto-configuration and management of ONTs with integrated IP-based services. The scope of this document doesn't address OLT, ONU, pure Layer2 ONT or the management of any remote units in the access network.

2.1   Definitions

The following terminology is used throughout this document.

ACS	Auto-Configuration Server. This is a component in the broadband network responsible for auto-configuration of the CPE for advanced services
B-NT	Broadband Network Termination, for any WAN-side access technology
CPE	Customer Premises Equipment, as defined in TR-069.
ODN	Optical Distribution Network. In the PON context, a tree of optical fibers in the access network, supplemented with power or wavelength splitters, filters, or other passive optical devices.
OLT	Optical Line Termination. A device that terminates the common (root) endpoint of an ODN, and implements a PON protocol, such as that defined by G.984. The OLT provides management and maintenance functions for the subtended ODN and ONUs.
ONT	Optical Network Termination. A single subscriber device that terminates any one of the distributed (leaf) endpoints of an ODN, and implements a PON protocol. An ONT is an ONU used in Fiber-To-The-Home and Fiber-To-The-Building cases.
ONU	Optical Network Unit. A generic term denoting a device that terminates any one of the distributed (leaf) endpoints of an ODN, and implements a PON protocol. This component is located in the field. The ONU provides the optical to electrical (O-E) and electrical to optical (E-O) conversion between the fiber and the copper wires that reach homes and offices in a "fiber to the curb" (FTTC) or "fiber to the neighborhood" (FTTN) scenario.
PON	Passive Optical Network

2.2 Conventions

In this document, 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 must 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.

3 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 document are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below. A list of the currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

[1] Broadband Forum TR-069 Amendment 2. CPE WAN Management Protocol, Broadband Forum Technical Report.
[2] Broadband Forum TR-104 Provisioning Parameters for VoIP CPE, Broadband Forum Technical Report.
[3] Broadband Forum TR-098 BroadbandHome Internet Gateway Device Data Model for TR-069, Broadband Forum Technical Report.
[4] ITU-T G.983.1. Broadband optical access systems based on PON. ITU-T recommendation.
[5] ITU-T G.983.2. ONT management and control interface specification for B-PON. ITU-T recommendation.
[6] ITU-T G.983.3. A broadband optical access system with increased service capability by wavelength allocation. ITU-T recommendation.
[7] ITU-T G.984.4. GPON: ONT management and control interface specification. ITU-T recommendation.
[8] IEEE 802.3ah. Ethernet in the First mile. http://www.ieee802.org/3/efm/index.html

4   Applying the CPE WAN Management Protocol to PON ONT

TR-069 describes the CPE WAN Management Protocol, intended for communication between a CPE and an Auto-Configuration Server (ACS). 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 CPE WAN Management Protocol is targeted at management of B-NTs. The protocol itself is transparent to the physical and link layer. The only assumption made is that the device must be IP addressable.

In broad terms, layer 3 auto-configuration is the same for a PON ONT as for a DSL B-NT. A PON ONT can be assigned an IP address via DHCP, IPCP, or static IP addressing. The main difference between the PON ONT and the DSL B-NT configuration and management is in the link layer.

At first, an initial configuration phase takes place on the PON layer (which is layer 1.5 actually) through which e.g. for B-PON and G-PON an ONT is assigned its PON ONT ID using PLOAM (Physical Layer OAM) messaging. The VP/VC or port-ID is given to the ONT on which the OMCI channel is carried (as defined in G.983.1 for B-PON and G.984.3 for G-PON). The OMCI (ITU-T G.983.2 for BPON) or G-OMCI (ITU-T G.984.4 for GPON) protocol addresses the ONT configuration management, fault management and performance management for BPON/G-PON system operation.

The MultiPoint MAC Control section of the 802.3ah specification describes the EPON discovery and configuration mechanism on the PON layer. 802.3ah also specifies an (optional) OAM mechanism allowing link monitoring and remote failure indication.

These protocols (PLOAM and, to some extent, OMCI/ G-OMCI for BPON and GPON, and 802.3ah for EPON) are the equivalent of ILMI for DSL B-NT link layer configuration and management.

There is quite a big difference between OMCI capabilities and 802.3ah. Briefly, the 802.3ah standard only describes some OAM capabilities on the link layer, and no provisioning capabilities to configure other CPE features. In contrast OMCI does specify quite extensive provisioning capabilities, including management of services such as voice services, circuit emulation services, etc.

Note that these protocols (PLOAM, OMCI, G-OMCI, 802.3ah) are only used in between the OLT and the ONT, as shown in Figure 1. In contrast, Figure 2 shows that TR-069 is transparent for the OLT and going directly from the ACS to the ONT and other CPE in the home network.

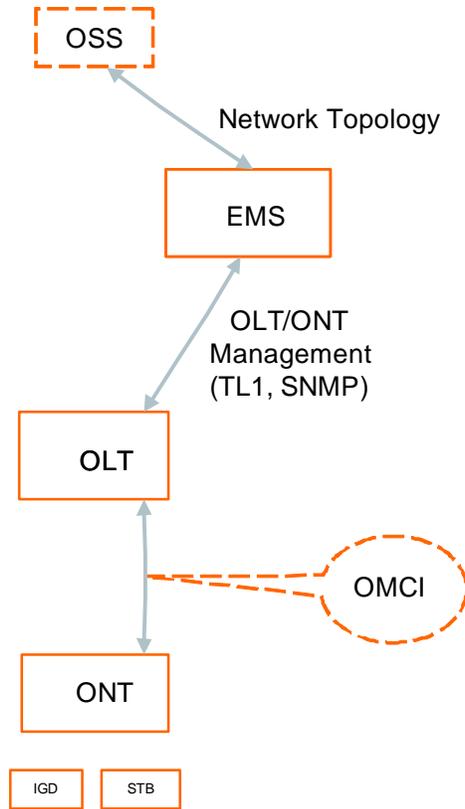March 2008   9

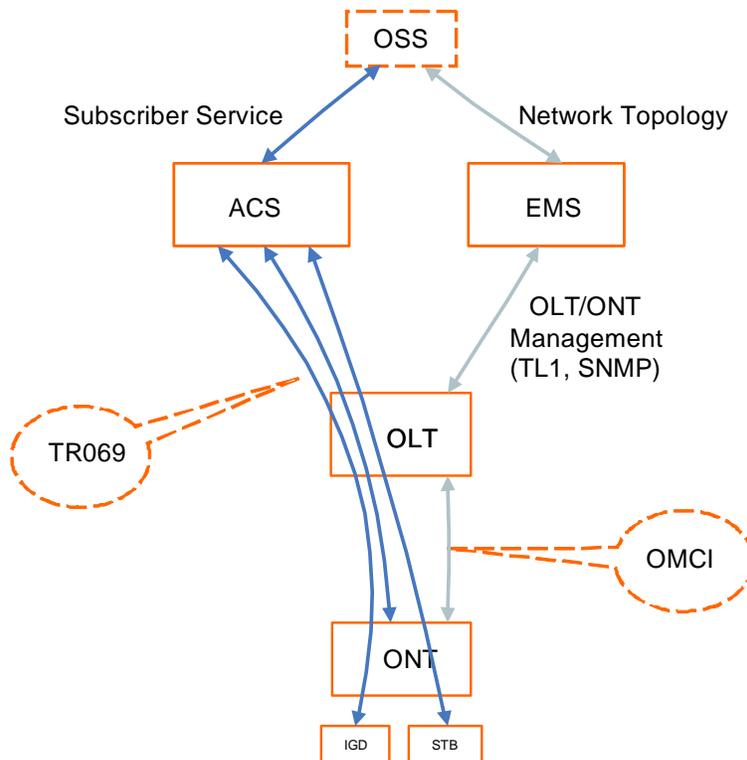Figure 1: Example of ONT link layer configuration and management.

Figure 2: Example of IP-based services configuration and management with TR-069 for PON access.

For the configuration and management of the PON ONT, PLOAM messages, OMCI and 802.3ah still play the role for which they were designed. The TR-069 protocol (CPE WAN Management Protocol) can complement OMCI (and related protocols) for the configuration and management of subscriber services, meaning services for layer3 and above. TR-069 can also overlap OMCI (and related protocols) in the configuration and management of the PON ONT itself. TR-069 is moreover used for the configuration and management of other customer premises devices (STB, VoIP, network storage elements…) as explained in TR-106. Note that it is not in the goal of this Technical Report to define a clear delimitation on the roles of OMCI and TR-069, as this is implementation-specific.

TR-069 is transparent to the OLT, since the TR-069 connections are established between the ACS and the ONTs, as shown in Figure 3.
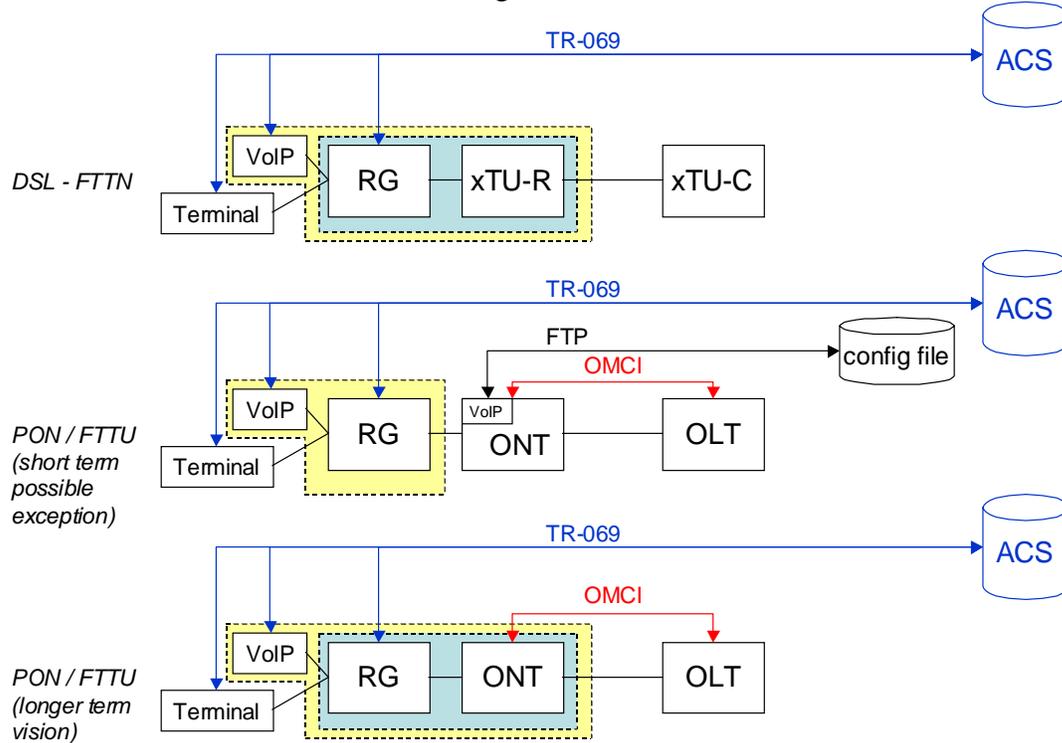

Figure 3: Example of TR-069 versus OMCI configuration and management.

Figure 3 shows 3 diagrams. The first one represents the situation today where TR-069 is used to configure and manage remotely, from the ACS, the parameters of the B-NT, as well as the services incorporated within it, such as the RG and for example a Voice over IP client.

The second diagram of Figure 3 shows a field situation, where the installed base of (BPON/GPON) ONT with an integrated Voice over IP client might not yet implement TR-069. In that case, OMCI might still be used either to communicate the URL of a configuration file to the Voice over IP client integrated in the ONT, or to configure the VoIP client itself, while other customer premises equipment (not integrated into the ONT) are configured and managed using TR-069.

The third diagram of Figure 3 shows the situation where the ONT supports TR-069. In this case, OMCI is still used for the link layer configuration and management, while IP-based services are configured and managed by TR-069. In this example, TR-069 would handle the RG functionality and a voice over IP client integrated in the ONT.

5   TR-069 profiles and object models for PON ONT

The following recommendations are provided for the configuration and management of IP-based services integrated in the PON ONT via TR-069.

5.1   Device profiles defined for PON ONT with integrated IP-based services to be configured and managed via TR-069

R-01 The PON ONT MUST support the baseline PON profile defined in TR-098 if TR-069 is to be used to remotely manage and configure this PON ONT.

R-02 The PON ONT MUST support the TR-104 EndPoint profile if a Voice IP service is supported and if TR-069 is to be used to remotely manage and configure this Voice service.

R-03 The PON ONT MUST support the SIPEndPoint profile if the device supports SIP and if TR-069 is to be used to remotely manage and configure this Voice service.

R-04 The PON ONT MUST support the MGCPEndPoint profile if the device supports MGCP and if TR-069 is to be used to remotely manage and configure this Voice service.

R-05 The PON ONT MUST support the H323EndPoint profile if the device supports H323 and if TR-069 is to be used to remotely manage and configure this Voice service.

R-06 The PON ONT MUST support the TAEndPoint profile if the ONT has POTS terminations and if TR-069 is to be used to remotely manage and configure this Voice service.