MARKETING REPORT

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TR-069 Deployment Scenarios

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Executive Summary

Global service providers have elected TR-069 as the management protocol of choice – offering rich management capabilities for a wide range of devices including DSL, cable, and Ethernet residential gateways (RG), fiber optical network terminals (ONTs), IPTV set-top boxes (STBs), network attached storage (NAS), powerline adapters, femtocells, IP phones, and more. All devices managed with TR-069 have a well defined data model associated with them defined by a family of TRs. As new devices emerge, the Broadband Forum works to define relevant data models, along with other enhancements, to ensure that new devices are capable of being managed by a TR-069 Auto Configuration Server (ACS).

TR-069 is access technology agnostic and as a result has found its way into a variety of service provider networks including DSL, fiber to the home (FTTH), Ethernet, and WiMAX. In some instances TR-069 is deployed in conjunction with other management protocols in use. For example, cable operators can use DOCSIS to manage the WAN portion of the cable gateway while using TR-069 to manage the LAN portion (including WiFi). Moreover, TR-069 can extend beyond the gateway to provide carrier class management of other networking devices and services in the customer premise.

Better managed broadband networks come as a result of using TR-069 to gain visibility and control of devices such as the RGs and STBs. Enabling zero-touch installations eliminates the expense associated with dispatching a technician to activate service. Leveraging the wealth of data that the ACS collects, in the form of analytics and reports, offers service providers visibility into business drivers such as network usage and activity, home network characteristics, and service utilization.

For service providers seeking differentiation and additional revenue opportunities, TR-069 is being used to deliver new portfolios of in-demand manageable data services. Examples include managed WiFi, content filtering, Internet time blocking, online backup, and home surveillance – just to name a few. Because these services are manageable via TR-069, take rates and retention are higher than they would be otherwise. In many instances the subscriber can simply call customer support and request that a service be configured on their behalf (e.g. block the teenage boys from playing on-line Wii games while the parents are asleep, and restrict the younger sister from visiting social networking sites).

Some subscribers prefer to be more involved in their home network - configuring devices and services on their own. This is one reason why TR-069-based subscriber portals have been deployed by a number of service providers as of recently. Since the portal is cloud-based the subscriber can access it from a variety of devices (e.g. laptops, TVs, mobile devices, Internet tablets, gaming consoles) from within the home or away.

With the advent of TR-069, service providers are presented with new possibilities in broadband deployments, including the ability to expand their services portfolio, manage the connected home or office, and build subscriber loyalty. Today, enabling the connected home or office is a reality for many service providers, and just around the corner for many more.

1 Introduction

All service providers share the same reality that more and more IP devices are making their way into their subscribers' homes at staggering rates. Likewise, today's subscribers want instant gratification which translates to what they want, when they want it. These trends present a number of challenges and opportunities for both service providers and solution vendors alike.

Today TR-069 is being used to manage millions of residential gateways (RGs) along with an increasingly wide variety of networking devices. TR-069 deployment scenarios vary based on the type of service provider (e.g. telco, cable, wireless) along with their business objectives. Some of the more innovative deployments involve portfolios of new manageable data services with corresponding subscriber portals that leverage TR-069.

The TR-069 value proposition enables service providers to enable the connected home and benefit from OPEX reductions combined with additional revenue opportunities through the delivery of manageable data services.

2 TR-069: A Brief Overview

In 2004, the Broadband Forum released the ground breaking CPE WAN Management Protocol (CWMP), more commonly referred to as TR-069. This specification defines a common communication mechanism between customer premise equipment (CPE) and a TR-069 Auto Configuration Server (ACS).

Initially service providers were focused on using the ACS to manage DSL and Ethernet residential gateways (RG). Today service providers are increasingly using the ACS to manage cable gateways, optical network terminals (ONTs), IPTV set-top boxes (STBs), network attached storage (NAS), powerline adapters, femtocells, IP phones, and more.

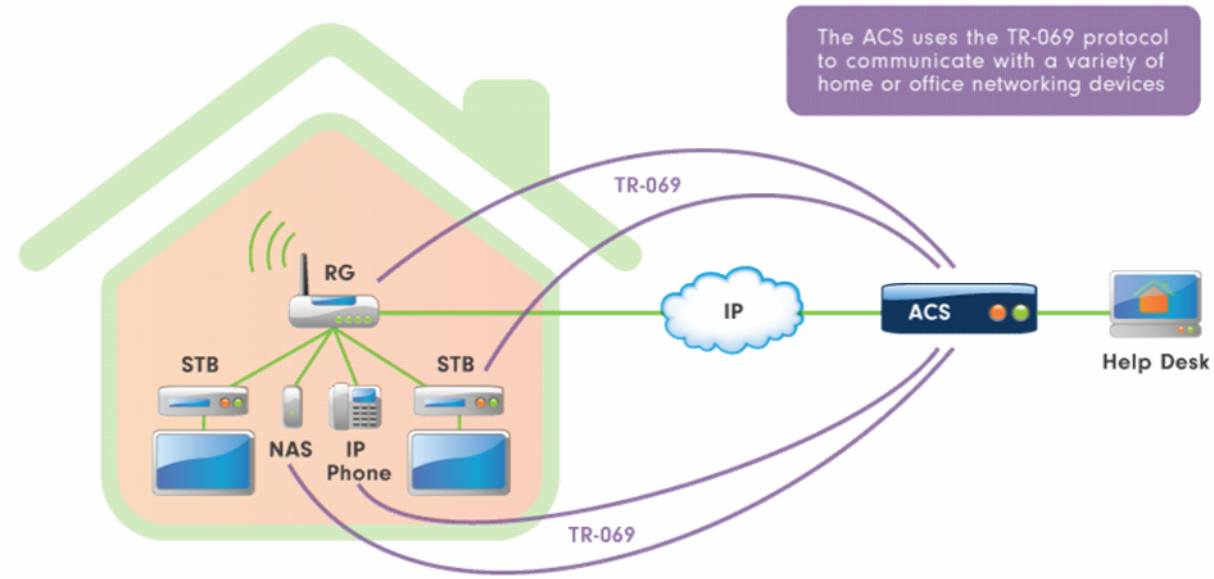

Figure 1 – TR-069 Management

All devices managed with TR-069 have a well defined data model associated with them (see **Table 1**). The data model is the set of common management objects for a given CPE – many if not all of which are remotely accessible by the ACS for provisioning, device management, and service delivery.

Service Management	Data Model
Residential Gateway (RG)	TR-098
All Devices, Including IGD (v2)	TR-181
Library of Reusable Objects	TR-157
IP Phones	TR-104
Set-top Box (STB)	TR-135
Network Attached Storage (NAS)	TR-140
Femtocell	TR-196

Table 1 – CPE and Associated Data Models

3 Many Markets, One Standard

TR-069 is access technology agnostic and as a result has found its way into a variety of service provider networks including DSL, cable, FTTH, Ethernet, WiMAX, and satellite. In some instances TR-069 is deployed in conjunction with other management protocols in use (e.g. SNMP, UPnP DM, OMA DM). The wide applicability of TR-069 enables service providers with distinct networks to benefit from a standards-based approach to device management and service delivery.

Consider a service provider intending to deploy multi-play services over DSL, cable, and FTTH networks:

- DSL: The service provider would deploy a TR-069 manageable DSL RG
  - Example: a VDSL2 RG with four Ethernet ports and 802.11n WiFi.
- Cable: The service provider would deploy a TR-069 manageable cable RG
  - Example: a cable RG with four Ethernet ports and 802.11n WiFi.
  - Service providers can use DOCSIS to manage the WAN portion of the cable RG while using TR-069 to manage the LAN portion (including WiFi, firewall, and services such as parental controls).
- FTTH: The service provider would deploy a TR-069 manageable ONT
  - Example: an indoor ONT with four Ethernet ports and 802.11n WiFi
  - If desirable, the service provider can also use the ACS to manage an Ethernet gateway behind an outdoor ONT.

TR-069's agnostic nature breeds confidence that a service provider's growth plans will not put them at odds with their TR-069 investment.

4 Better Managed Broadband Deployments

4.1 Managing the RG

Rising fuel costs and overburdened support personnel affect service providers across the globe. TR-069 enables the service provider to remotely see and manage the subscriber's RG along with other devices in the home or office network. A support call that used to require a site visit or take considerable time over the phone to resolve can now be handled remotely or avoided completely.

Customer support can instantly observe the status of the RG, the connection state of all LAN devices (e.g. on-line or offline), and the connection type (e.g. WiFi or Ethernet). If a LAN device is disconnected the support call can be focused on establishing basic connectivity rather than going through a long checklist of exercises. If the RG requires updated firmware or configuration changes the ACS can issue the appropriate action remotely without requiring any involvement from the subscriber. Per-device and bulk operations are both supported.

4.2 Zero-touch Installation

In the past, service providers have been faced with manually pre-provisioning the RG with custom settings (e.g. authentication credentials, IPTV configurations, service provider branded WiFi SSIDs, QoS) before service could be rendered. In many instances the service provider would also require the RG equipment vendor to furnish custom firmware images locking down a variety of settings. A large number of service providers would therefore need to maintain multiple inventories of the same physical RG based on the firmware image.

For example, one firmware image might have been required for all IPTV deployments and another for Internet only. If the incorrect RG was deployed it would likely result in a long support call or possibly require a technician to be sent onsite. If a RG needed to be replaced then all of the subscriber's settings would be lost along the way (e.g. WiFi settings and port forwards). This outcome would force the service provider to spend considerable time helping the subscriber restore their RG's configuration so that all devices and services worked as they did beforehand.

TR-069 has made zero-touch RG installations a reality. Today, the ACS can work in concert with the RG to provision custom settings. If the RG ever goes to factory defaults (e.g. by a subscriber pressing the 'reset' button, a lightning strike, or a power surge) or is replaced, the ACS can push the last known configuration to the RG restoring all functionality. Moreover, if the RG ever needs to be replaced the service provider can simply send a replacement RG to the subscriber and update the ACS accordingly - all configuration data for the previous RG will be automatically pushed to the replacement RG.

4.3 Enhanced IPTV Deployments

Service providers are increasingly using the ACS to manage their set-top boxes (STBs) alongside the RG and other devices in the home or office network. Having a single management platform that offers comprehensive visibility and control of all devices enables the service providers to improve operational efficiency and offer better customer support.

Using TR-069 to monitor the STB helps service providers be proactive and troubleshoot IPTV issues before the subscriber is aware that an issue exists. If a STB experiences performance issues then the ACS can trigger an alarm, or even initiate a sequence of actions intended to rectify the issue.

TR-069 is also used to configure LAN ports on the RG to accommodate any number of IPTV set-top boxes offering greater deployment flexibility. For example, if a current IPTV subscriber requests a set-top box for a new TV, the service provider can simply send the equipment and have the ACS provision the RG and STB in advance. If the subscriber downgrades from IPTV to an Internet only plan, the service provider can remotely reallocate Ethernet ports on the RG to accommodate additional home networking devices.

4.4 Better Decision Making with Analytics and Reporting

The ACS enables service providers to collect an increasingly broad range of data relating to the subscriber, associated devices, and service delivery. Summarizing this data and creating customized reports offers service providers visibility into business drivers such as network usage and activity, home network characteristics, and service utilization. Various groups within the organization (e.g. Customer Support, Sales and Marketing, Network Operations, and Leadership) can access meaningful reports that are relevant for their particular business unit resulting is better overall decision making.

Sample use cases:

- Understanding which RGs are frequently experiencing DSL retrains enables customer support to be proactive and troubleshoot before the customer calls in.
- Information on subscribers' bandwidth utilization enables maintenance activities to be scheduled at the least disruptive time.
- Subscribers identified with one or more WiFi capable devices (e.g. laptops, IP cameras, Internet photo frames) can be targeted for a managed WiFi offering.

5 Leveraging TR-069 to Deliver Manageable Data Services

In addition to providing rich management capabilities, TR-069 is also being used by service providers to deliver a portfolio of in-demand manageable data services.

Examples might include:

- managed WiFi and firewall
- parental controls (content filtering and Internet time blocking)
- IP video
- online backup, storage, and access
- quality of service (QoS)
- media management (e.g. music, photo, and video sharing)
- broadband usage limits (limits downloads to an agreed upon amount)
- VoIP and femtocells
- home automation, controls, surveillance and security
- green services such as energy, water, and gas management

Manageable data services are typically sold à la carte, or bundled with complementary services (e.g. managed WiFi *plus* content filtering *plus* Internet time blocking for $7.95 per month). In some instances a service provider will choose to give away a service to help offset a competitive threat. For example, a service provider might include managed WiFi as part of their standard broadband offering knowing that their competition does not have a WiFi solution.

Service providers that possess a portfolio of manageable data services see greater profitability, increased customer loyalty, and decreased customer churn.

6 End-to-end Service Delivery

Often service providers integrate their billing, support, policy, and order management systems with the ACS (via the ACS's Web Services API) to achieve end-to-end service delivery. This decreases the time involved in activating services and reduces errors by eliminating human intervention.

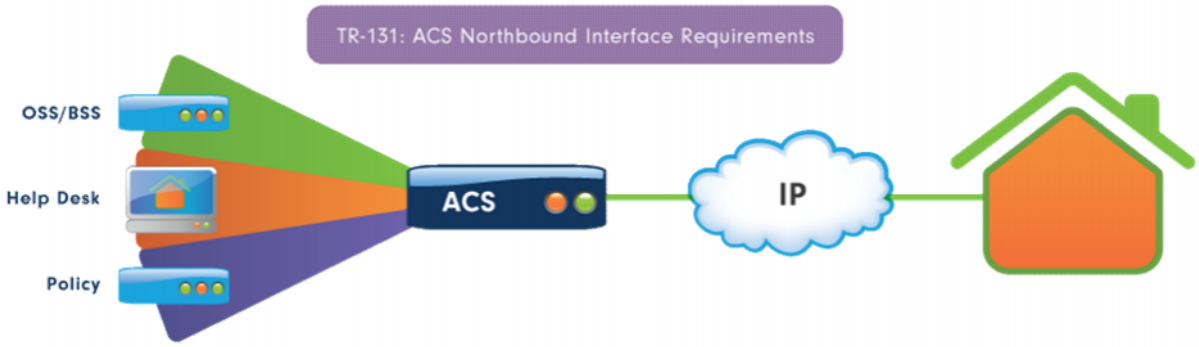

Figure 2 – ACS Interfacing via the API with Network Systems

7 TR-069 and the Subscriber

Historically subscribers have been required to login to the RG's local interface (GUI) to accomplish basic tasks (e.g. configuring WiFi security, setting up port forwards so that a device or application will work as expected). The reality is that most subscribers find this to be a challenging proposition as the RG's interface is often too complex attempting to be all things to all people (i.e. provide the service provider with sophisticated operational settings while providing the subscriber access to necessary features). Moreover, if subscriber access to the RG's interface is permitted, there is the likelihood that they will inappropriately change basic configuration settings resulting in the RG going out of service. The eventual outcome is a call into customer support which is unfortunate for all parties involved.

As an alternative to the RG's local interface, forward thinking service providers now offer a TR-069-based, custom branded subscriber portal that only displays content and functionality that is relevant for the subscriber. Since the portal is cloud-based the subscriber can access it from inside the home, or wherever an Internet connection can be found. Additionally, the subscriber portal can be accessed through multiple screens (e.g. laptops, TVs, mobile devices, Internet tablets, gaming consoles) offering subscriber convenience and satisfaction.

Figure 3 – The Subscriber Portal: Many Services to Many Screens

The subscriber portal can enable the subscriber to see all of their networking devices (e.g. device name, device type, how they are connected, if they are connected) as well as provide a single interface for device configuration and service access (e.g. WiFi settings, port forwards, content filtering settings, home surveillance feeds, energy management data).

The content in the portal can be dynamically rendered without requiring an RG firmware upgrade – this enables relevant ads and promotions to be served up based on data collected by the ACS. For example, if multiple computers are detected on the home network, a promotion for content filtering can be displayed. Or, if a gaming console is detected on the home network, a promotion for Internet time blocking can be inserted.

8 Enabling the Connected Home or Office

There are a number of key dynamics shaping consumer choices - more devices in the home and office network, more valid broadband choices, and more competitive services from a variety of sources. With the rise of the "Broadband Generation," service providers need to be in a position to offer consumers what they want, when they want it, and on the device of their choice. This forces service providers to look for new ways to retain subscribers and attract new ones. The alternative is to continue providing the broadband pipe and relinquish the profitable services business to Over-the-Top (OTT) competitors.

TR-069 is revolutionary in the sense that it offers new possibilities in broadband deployments, including the ability for service providers to expand their services portfolio, provide the connected home or office, and build subscriber loyalty. By using TR-069 to manage the RG and other relevant networking devices, OPEX savings will be instantly realized. Moreover, by offering a suite of manageable data services along with a cloud-based subscriber portal, ARPU will be increased along with top line revenue.

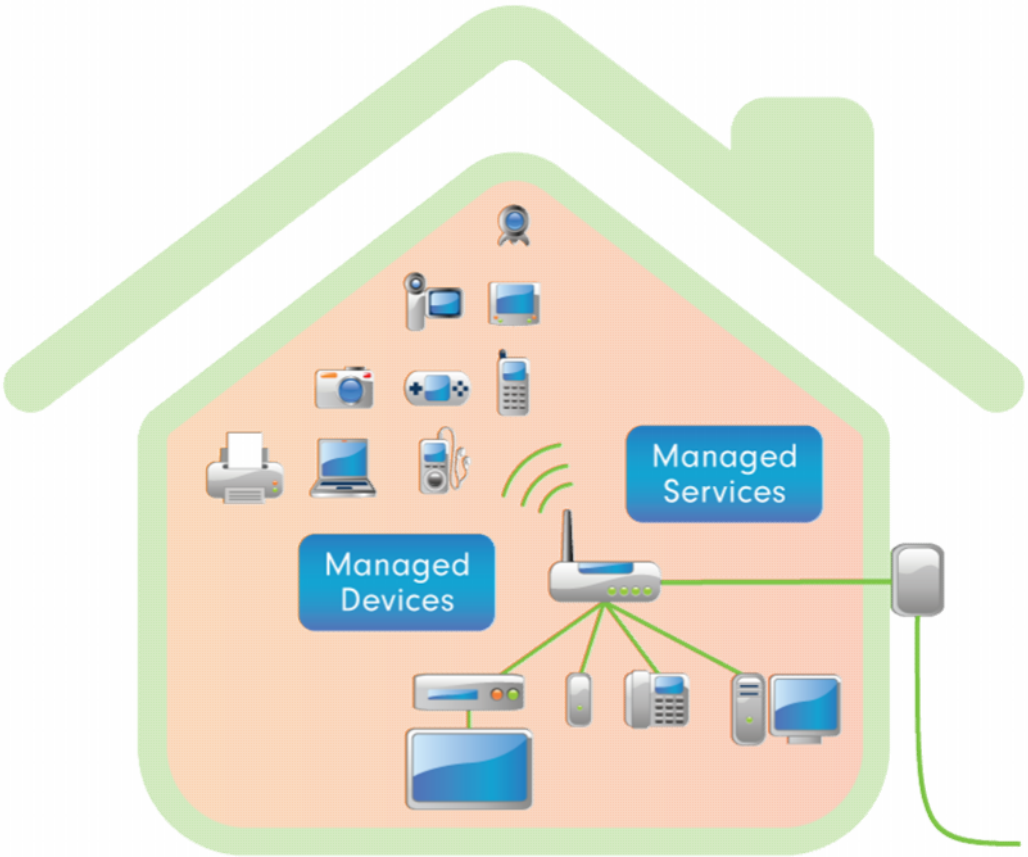

Figure 4 – The Connected Home

With the advent of TR-069, it is no longer a question as to how a service provider can enable the connected home or office – it is simply a function of their resolve to do so.

9 Next Steps for TR-069 Family of Specifications

Though TR-069 is robust, flexible and widely deployed, market requirements are always changing and there is always room for improvement. Looking forward, recent specifications have been completed as well as new work launched to address some important areas:

Root Data Model for All Devices

One of the most important pieces of recently approved work is TR-181 Issue 2. This specification re-designs the interface-related parts of the data model, converging Device and IGD (Internet Gateway Device) data models into a single root data model; the Next Generation root data model for all devices.

With these enhancements, the new model represents interfaces in a more flexible, robust fashion which better reflects network stacks. By simplifying and converging to one root data model platform for all devices, we are empowering capabilities that were challenging or

not possible with existing Broadband Forum TR-069 related specs, including the time-sensitive IPv6 migration.

Remote Management of Non-TR-069 Devices

This work item defines full remote management of non-TR-069 devices, both for those that are IP based and for those that are not. It provides support for most management functions, and covers all the new objects, parameters and protocol extensions that are needed to accomplish management of these non-TR-069 enabled devices, whether IP-based or not.

Software Module Management using TR-069

As the home networking market matures, CPE in the home are becoming more sophisticated and more complex. One trend in enhanced device functionality is the move towards more standardized platform and execution environments (such as Java, Linux, OSGi, etc.). Devices implementing these more robust platforms are often capable of downloading new applications dynamically, perhaps even from third-party software providers.

In order to address the need of providing more compelling dynamic applications on the CPE while ensuring a smooth "plug and play" user experience, it is necessary for service providers to make use of TR-069 to remotely manage the life cycle of these applications, including download, install, activation, upgrade, and removal. Doing so ensures a positive user experience, improves service time-to-market, and reduces operational costs related to provisioning, support, and maintenance.

Software Module Management using TR-069 presents new requirements related to TR-069 for management of dynamic software applications as well as relevant CWMP and component data model updates. These updates will be published as additional components and/or enhancements to TR-069.

Conclusion

The above represent significant enhancements to the BroadbandHome™ family of TRs. The Broadband Forum will also be adding in data models for additional capabilities, creating a clean platform for future capabilities. The changes that will result will future proof TR-069 for upcoming needs including IPv6, enhanced management of CPE through object addressing extensions, VoIP (including IP PBX and DECT), STB, throughput performance testing, G.hn LAN, PON WAN, and IGMP snooping and proxying.

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