

# ***Network Quality Control***

Setting the standard for  
Quality of Experience



# Who we are

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- The Broadband Forum is a worldwide organization committed to rapidly creating specifications for communication service providers and vendors that-
  - accelerate the development and deployment of broadband networks,
  - ensure successful interoperability,
  - manage and deliver advanced IP services to the customer.

# Broadband Forum Scope

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- Create a Common Global Access and Control Platform to Elevate the Experience of Next Generation IP Services
  - Developing an **Access and Management Platform**, responsive to devices beyond the customer gateway as well as the distribution network.
  - Ensure **Service Delivery Excellence**
  - Specifying **Common End-to-end Architecture** for ALL forms of broadband access for upper layer protocols
  - Defining **Common CPE specifications** for all forms of broadband access
  - Advancing **ADSL2plus and VDSL2 interoperability**

# Evolving Quality Requirements

## Data only

- In the era of single play, it was possible to simply rely on the increase in access speeds (e.g. in moving from dial-up to ADSL) to keep customers happy
  - Most Internet access was used for surfing the World Wide Web (WWW) or E-mail
  - WWW content was predominantly static graphics and text with limited streaming
  - The only early streaming content was low bandwidth radio stations
- Network providers could simply-
  - Use more bandwidth to provide adequate QoS
  - Rely on the packet re-transmission feature of TCP in the architecture's TCP/IP protocol stack to cover up any IP packet loss due to inadequate engineering or intermittent congested network links

# Double Play Requirements

Adding voice services leveraged the IP transport and access speeds of broadband to offer cost-effective VoIP services, often with new features.

- These services could be offered independently of the access provider by relying on the sheer speed and capacity of broadband access to the Internet to facilitate adequate QoS.
  - Lower pricing of the double play service bundles meant many customers would tolerate the occasional quality aberration
- Other providers evolved their architectures to provide fully engineered QoS between the customer's phone and the VoIP softswitch to guarantee QoS.
  - Ensuring the quality of the voice call would always be as good as analogue primary line voice (as measured by Mean Opinion Score – MOS)
  - Unfortunately MOS quality of VoIP is not something that is easily cost justified

# Triple Play Changes the Requirements

- The broadband industry has now entered a new era of “triple play” service bundles where service providers seek to offer data, voice and video services in a single package.
- This bundling of services over a single converged IP network to both reduce costs and increase functionality presents a number of challenges to network providers.
  - Bundling increasingly highlights the quality of network engineering as a competitive differentiator due to its profound impact on service performance, functionality, cost and time-to-market for new products.
  - Adding video into the service mix means that no short-cuts can be taken.

# Video changes the rules

- Video has extremely onerous quality requirements and any network engineering deficiencies are immediately apparent to the customer (in terms of subjectively annoying video artefacts or sound track problems).
  - As video compression evolves and deployment of HDTV over broadband networks increases, the sensitivity of the customer's Quality of Experience (QoE) to the network architecture and it's implementation will increase
  - Inadequacies in network architectures result in-
    - Detrimental jitter
    - Packet loss and
    - Multicast channel change latency, which will be immediately apparent to the customer.
  - Standardized approaches to multi-service broadband architectures do exist such as TR-101 which provides a QoS and multicast blueprint.

# What are the provider's options?

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- Any network operator with deep enough pockets can increase capacity and fiber link speeds in the core and metro.
- However, last mile access will always be a potential bandwidth bottleneck, especially with the advent of HDTV with IPTV.
- It can be complex to design broadband networks to most effectively exploit techniques like:
  - hierarchical scheduling for QoS and
  - leveraging multicast techniques.



# Architecture & Control are core requirements

Effective, efficient broadband network architecture and its associated engineering design and policy management are vital in today's competitive market and will become a key differentiator between network providers.

The benefits:

- better service capability,
- customer's quality of experience,
- reduced operational costs,
- more efficient use of capital invested in the network and
- Subsequent rapid product development justifies it.

# How the Broadband Forum is helping



## What does the industry need?

### Industry Requirement

Cost-effective high-speed access to the home

Network architecture supporting end-to-end  
QoS with security, reliability & policy  
management

Efficient remote management of devices  
by the service provider

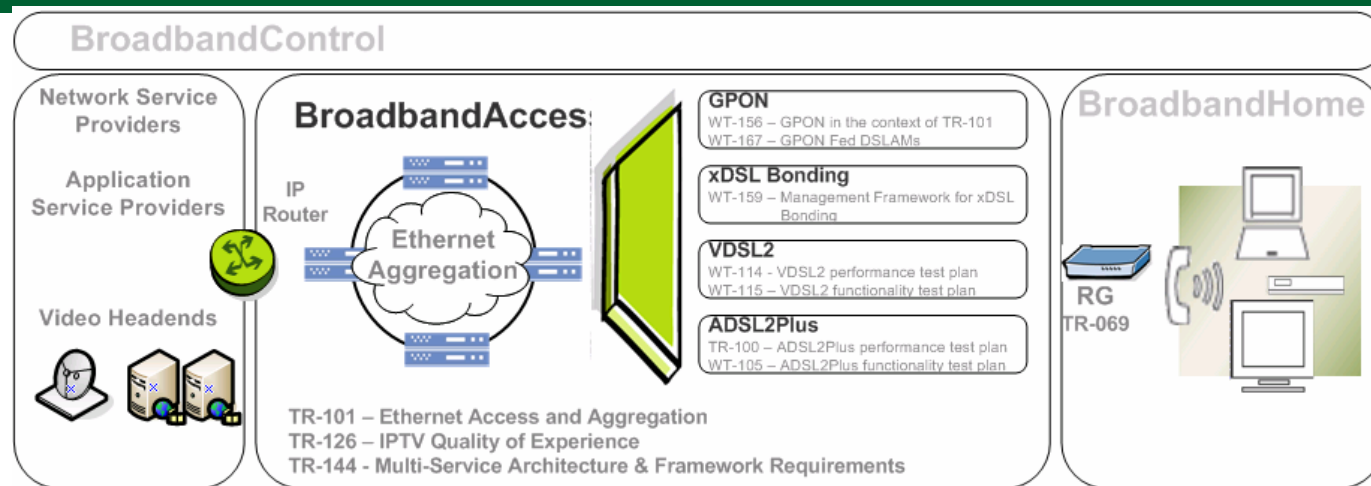
Multi-vendor interoperable CPE

Effective triple play networking within the home

## Broadband Forum's IPTV Work Takes Center Stage

Focus Area	Completed Work	Work in Progress	New work being initiated
<b>Digital Home</b>	TR-135 Data Model for a TR-069 enabled Set Top Box TR-140 Data Model for a TR-069 Enabled Storage Device TR-069 CPE WAN Management Protocol TR-098 IGD Data Model TR-106: common data model template TR-142 Framework for TR-069 Enabled PON Devices	IPTV Installation Best Practices White Paper IPTV configuration Best Practices White Paper	Quad-play service Management
<b>Next Generation Access</b>	TR-101 Migration to IP Ethernet Access Aggregation TR-126 Triple Play QoE Requirements	WT-114 VDSL2 Performance Test Plan WT-115 VDSL2 Functionality Test Plan WT-105 ADSL2plus Functionality Test Plan WT-145 TR-101bis WT-156 Extending TR-101 to GPON	DSL Line Profiles DSM/DLM for Video Services Transport & Home Network Quality of Service and Experience Testing for IPTV delivery
<b>Network Operations &amp; Policy Control</b>	TR-113 MCM Specific Managed Objects in VDSL Network Element TR-063 VDSL Network Element Management	WT-134 Policy Management Framework WT-146 IP Sessions WT-147 Layer 2 Control Mechanism PD- 160 IPTV Performance Monitoring & Diagnostics WT-159 Management Framework for xDSL Bonding	

# Improving Access/Architecture Requirements



- TR-126 documented the requirements for IPTV (both standard definition and high-definition)
  - This work was extensively liaised to standards bodies like ATIS and ITU who used it to inform much of their own work in this area.
- TR-101 provides:
  - Blueprint for how to build a multiservice/triple-play broadband network and includes the functional requirements of all the key network elements (Residential Gateway/DSL router, Access Node/DSLAM, aggregation network and Broadband Network Gateway (BNG)).
  - Functional requirements to cover the capabilities needed to deliver IPTV with multicast and QoS (see also TR-92 for more background on BNG QoS requirements such as hierarchical scheduling).
- TR-101 architecture is currently being extended to encompass GPON access via WT-156.

# Performance is key

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- Given a good architecture like TR-101 and good design implementation and capacity management then the delivery of IPTV over the core and aggregation networks should be well assured.
- Then, the most likely root cause for IPTV QoE problems experienced by an end-user is likely to be the DSL line (copper) or home network.
- Hence the Broadband Forum has put a huge amount of effort into the performance requirements and associated testing of the DSL layer transmission systems
  - TR-100 for ADSL2plus and
  - WT-114 for VDSL2

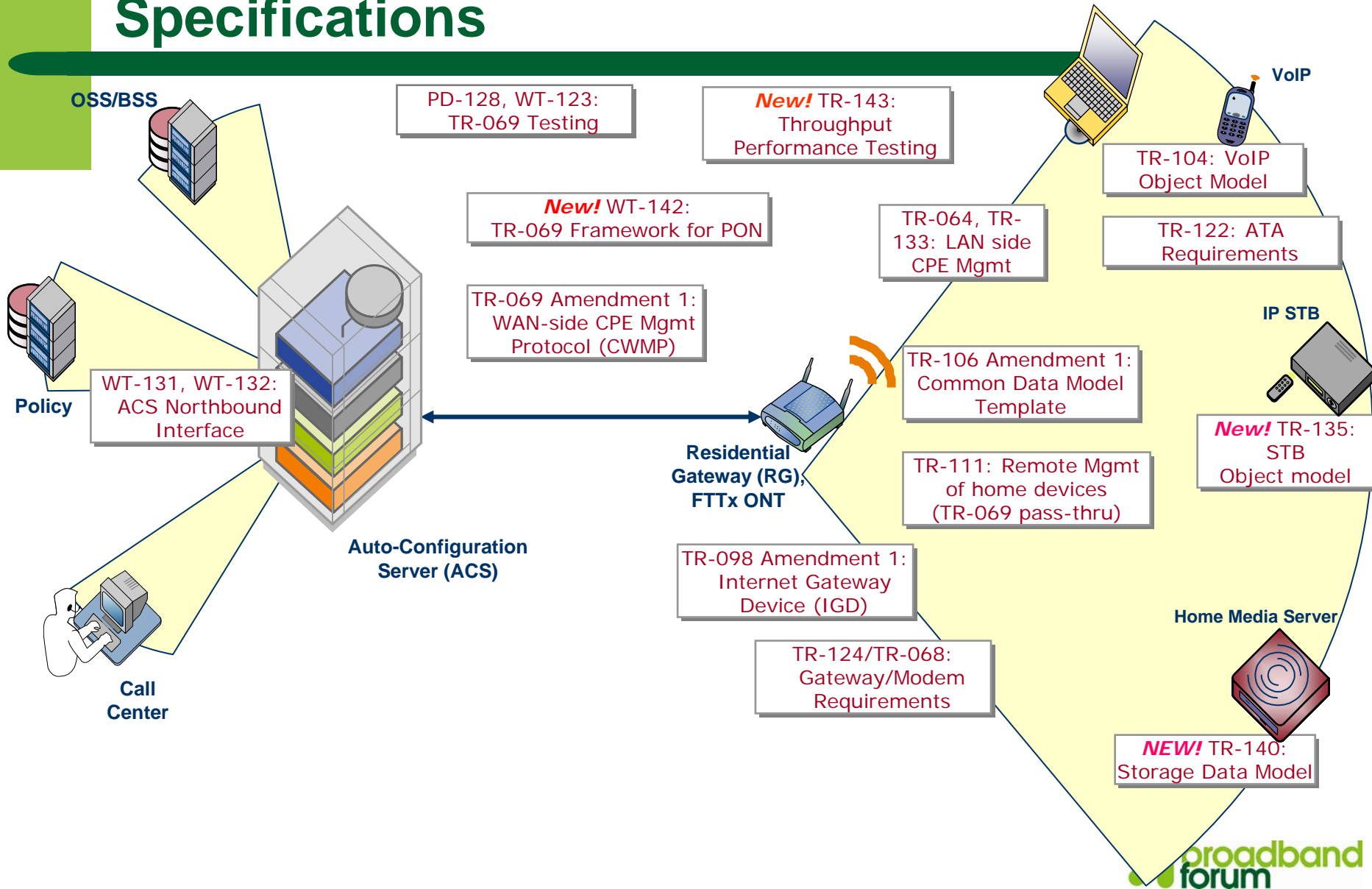
# Broadband Forum-

## Supporting the digital home



**Frightening Complexity for End Users**  
**New Domain for Providers**

# Broadband Home Remote Management Specifications





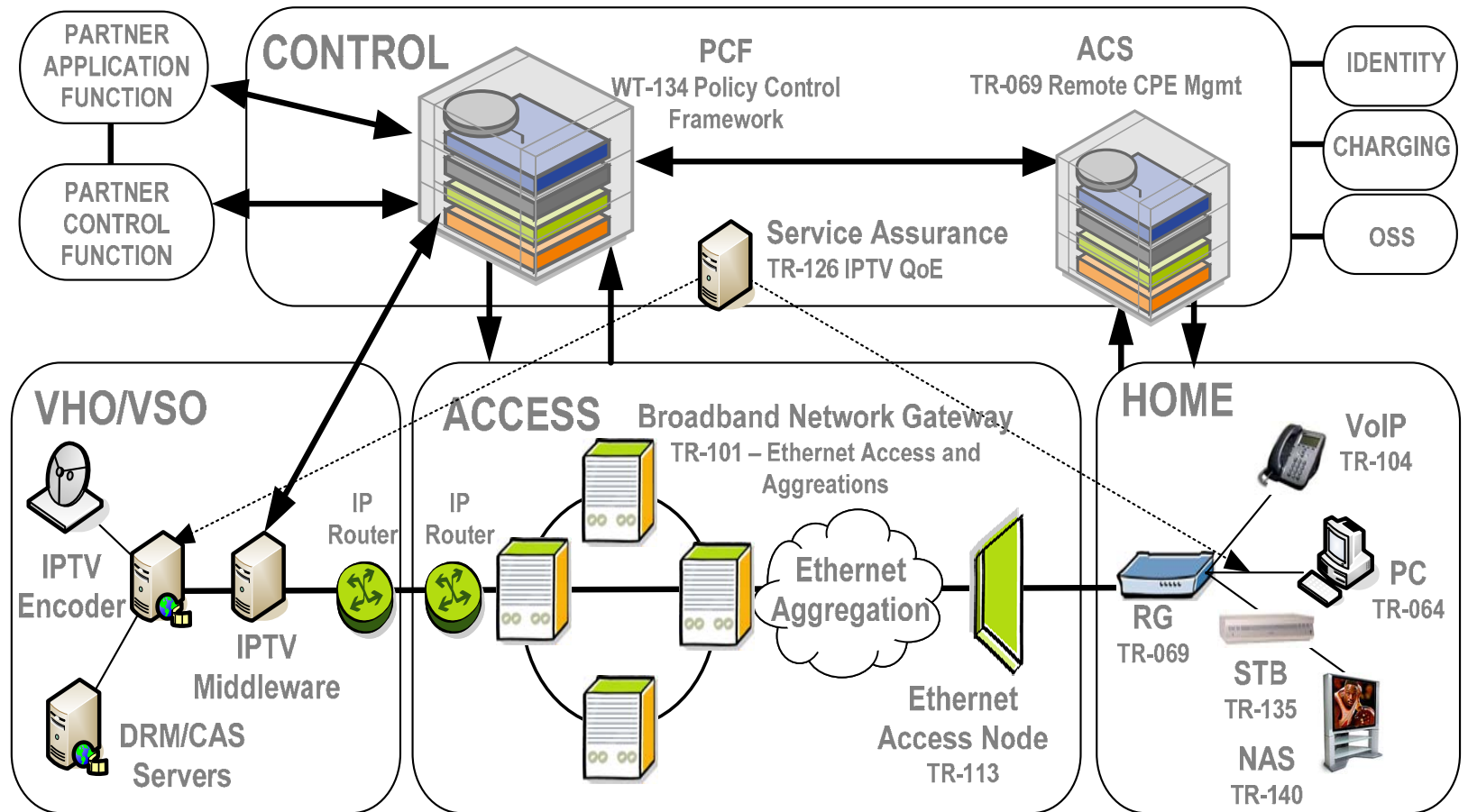
# Quality Standards for the Home

*Work in development*

- Additional work is addressing QoS in home networks *(in conjunction with HGI – Home Gateway Initiative)*.
  - Extend the geographic coverage of IPTV by extolling the virtues of various transmission approaches that can give improvements (PD-180).
  - Specific recommendations for DSLAM profiles to be used to deliver IPTV over ADSL2plus (WT-176).
- Service providers are seeking to improve their business case for IPTV over DSL by enabling end-users to self-install the equipment.
  - It is important that this is done correctly to ensure the appropriate IPTV QoE is not compromised by DIY installations
  - We are producing an IPTV Installation best practice guidelines in this area (PD-179).

# BroadbandSuite™

Provides the Access, Home and Control Specifications  
for Service Optimization



# Conclusion – The Broadband Forum's Role

Industry Need	Broadband Forum Work
Improvements in Speed	Test Plans and Events to improve interoperability of various speed options Current work on VDSL2 test suite (WT-114, WT-115)
Improvements in Network Quality	<b>TR- 126:</b> Compendium of measurements and provision guidelines to ensure quality of experience of certain applications <b>TR-101:</b> Migration solution to move from ATM access aggregation to IP Ethernet
Simplifying management of the Digital home	BroadbandHome family of TRs (TR-69, TR-143, etc) New Common Object Models- STB, Storage, VoIP, etc Self Installation best practices
IPTV takes center stage	Speed, quality experience and management enhancements are taking broadband service delivery to a new level of excellence

# New Formal Release Program

- **BroadbandSuite Release 1.0**

Internet access via ADSL or SHDSL over a QoS-enabled ATM architecture. Supports VoIP transport & VoDSL

- **BroadbandSuite Release 2.0**

Triple-play access via ADSL2plus (or ADSL) over a QoS-enabled Ethernet architecture. Full support for multicast to enable IPTV streaming

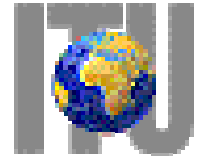
- ***Coming in late 2008!* Release 3.0**

Triple-play access augmented via GPON or bonded DSL over a QoS-enabled Ethernet architecture. Full support for multicast to enable IPTV. Integrated remote management of Set-Top Box & attached storage devices

# Next Steps

- The Future of gateway/modem requirements
  - The Broadband Forum will continue to add additional interface feature modules to maintain current with RG market demands
    - Add new features or network devices as service deployments require
    - Add new WAN/LAN interfaces as they are introduced to market (e.g. Bluetooth, GPON, WiMAX, etc.)
- Full QoS in BroadbandHome
  - Refine Home Network Reference Model
  - Extend DSL Forum Network Requirements (TR-059) to the Home
  - Adopt/Leverage QoS Specifications defined by other standards groups such as UPnP, DLNA, IETF, HGI
- Continue to align with the industry
  - Continued educational efforts to ensure these specifications are referenced by standards bodies

# We don't work alone



International  
Engineering  
Consortium  
[www.iec.org](http://www.iec.org)



Home Gateway Initiative



***Thank you for taking time to learn more  
about the Broadband Forum's work***

