

Application Note

Testing Cable VoIP using DOCSIS® Transponders

Cable MSOs can perform true voice-channel service quality testing to Tollgrade's PacketCable™-based transponders and End-of-Line probes throughout the HFC using Minacom's DirectQuality R7 Service Level Test Automation Platform.

Overview

Tollgrade's widely deployed DOCSIS®-based Status Monitoring Cheetah® Transponders and ruggedized End-of-Line (EOL) probes are fully compatible with Minacom's award-winning VoIP responder test technology, allowing user-perceived speech and service quality testing over true PacketCable™ voice channels throughout the hybrid fiber/coax (HFC) network. The integrated remote-testing solution can significantly reduce the time required to identify, isolate and diagnose VoIP service issues, while also providing proactive, real-time monitoring to detect service level degradation before quality issues affect subscribers. Test automation, results analysis, service level classification, fault management and reporting are controlled by Minacom's DirectQuality® R7 web-based OSS, already deployed in the networks of over 70 service providers worldwide.

Unique to the industry, Tollgrade's Cheetah transponders' embedded MTAs (eMTAs) are PacketCable 1.0 "Verified for Interoperability" by CableLabs, and fully compliant with PacketCable Security and Dynamic Quality of Service (DQoS) specifications. Adherence to these standards ensures that tests conducted using Cheetah transponders will carefully predict user-experienced service quality,

To perform VoIP testing, Minacom's PowerProbe® 6000 service level test probe, connected to the gateway's T1 PRI interface, places a call to the transponder's eMTA to initiate a sequence of Minacom-proprietary test traffic over the voice-path. The PowerProbe 6000 records and analyzes the test call to provide over 40 VoIP QoS metrics, including speech quality (MOS), speech power, loss, distortion, clipping and noise, call connectivity metrics such as Post Dial Delay (PDD), as well as dual-tone multi-frequency (DTMF / Touch Tone) transparency. This Minacom patent-pending, originally developed for subscriber MTA loopback testing, functions transparently with the eMTA in Tollgrade transponders, as the eMTA is provisioned as an actual subscriber by the softswitch / Call Management Server (CMS), originating and terminating calls under program control.

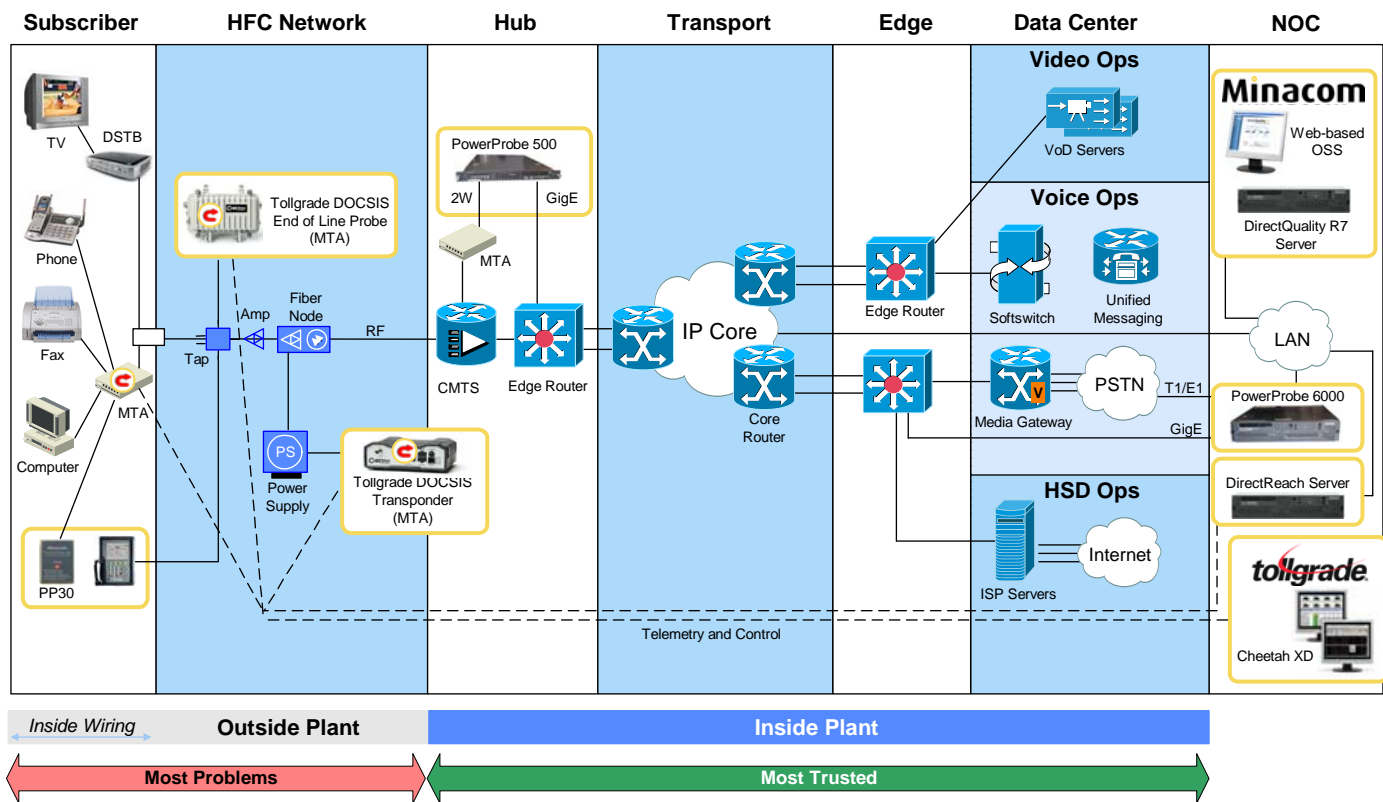


Figure 1 – VoIP Service Assurance Solution Architecture

Complementing eMTA true voice-path testing, Minacom’s SMRP-based loopback tests to Cheetah transponders can be used to assess a network’s ability to deliver Internet and data content including HDTV and VoD digital video streams.

Instrumenting the HFC network using MTA-embedded Tollgrade transponders as test responders provides operators with a strategically located constellation of benchmark VoIP test points to conduct location-based testing and network segmentation. Remote testing to these transponders provides comprehensive HFC VoIP service level monitoring, as well as rapid service issue isolation and characterization to accelerate repair time, optimize proactive maintenance schedules, and reduce costly technician deployment.

Resolving Service Issues

If a customer complaint indicates a possible VoIP service quality problem, cable operators can first remotely confirm and characterize the issue using Minacom’s MTA loopback VoIP test directly to the subscriber’s residence. Once an issue is validated and identified, problem resolution is facilitated by isolating its point of origin within the cable operator’s network. Remote testing to the Tollgrade transponder and/or End-of-Line probe on that customer’s coaxial leg are conducted to determine the nature of the problem, whether local to the customer premise or common to the access network. By repeating tests to other transponders in the HFC, the problem location can be precisely identified. Once the nature and location of the fault are known, traditional domain-specific tools are used to complete problem diagnosis and service restoration - including data from return-path monitoring systems, CDRs from softswitches, and results from handheld test tools used by field technicians (Figure 2, below)

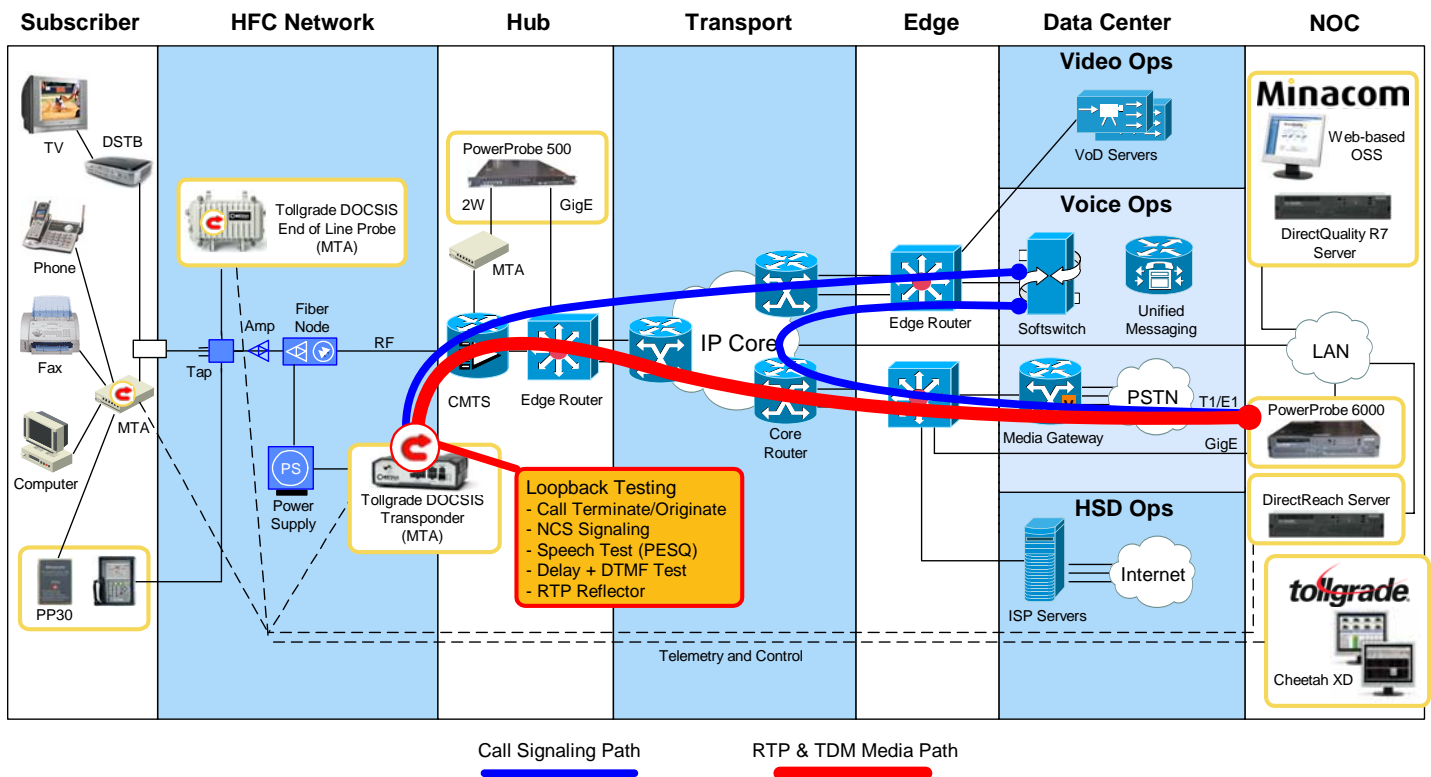


Figure 2 – Transponder Loopback Testing

By integrating DirectQuality service level test automation OSS with Tollgrade’s Cheetah XD™ transponder EMS / topology database, cable MSOs can remotely test from the Cable Modem Termination System (CMTS) or Network Operations Center (NOC) to specific transponders located in a subscriber-serving region. This powerful technique can determine if a problem originates from the HFC plant and its exact location if it does.

Proactive Monitoring

Service quality monitoring is performed by scheduling automated VoIP service quality tests to critical locations in the Cable VoIP network - hubs, power supplies, coaxial end-of-line locations, and customer premises - using DirectQuality R7's web-based test automation. By regularly testing the HFC, IP/Fiber, Media Gateway, and Voice Operations network domains, operators can determine how service quality varies by location, network segment, and time of day (low/peak-usage hours). By setting service quality thresholds within DirectQuality for key VoIP quality metrics such as MOS, echo, latency, jitter, post-dial delay (PDD), and call completion ratio (CCR), reports can indicate which aspects of VoIP service are degrading, and how quickly. Integration with existing / legacy operational support systems provides northbound service-level alarms to existing fault management systems.

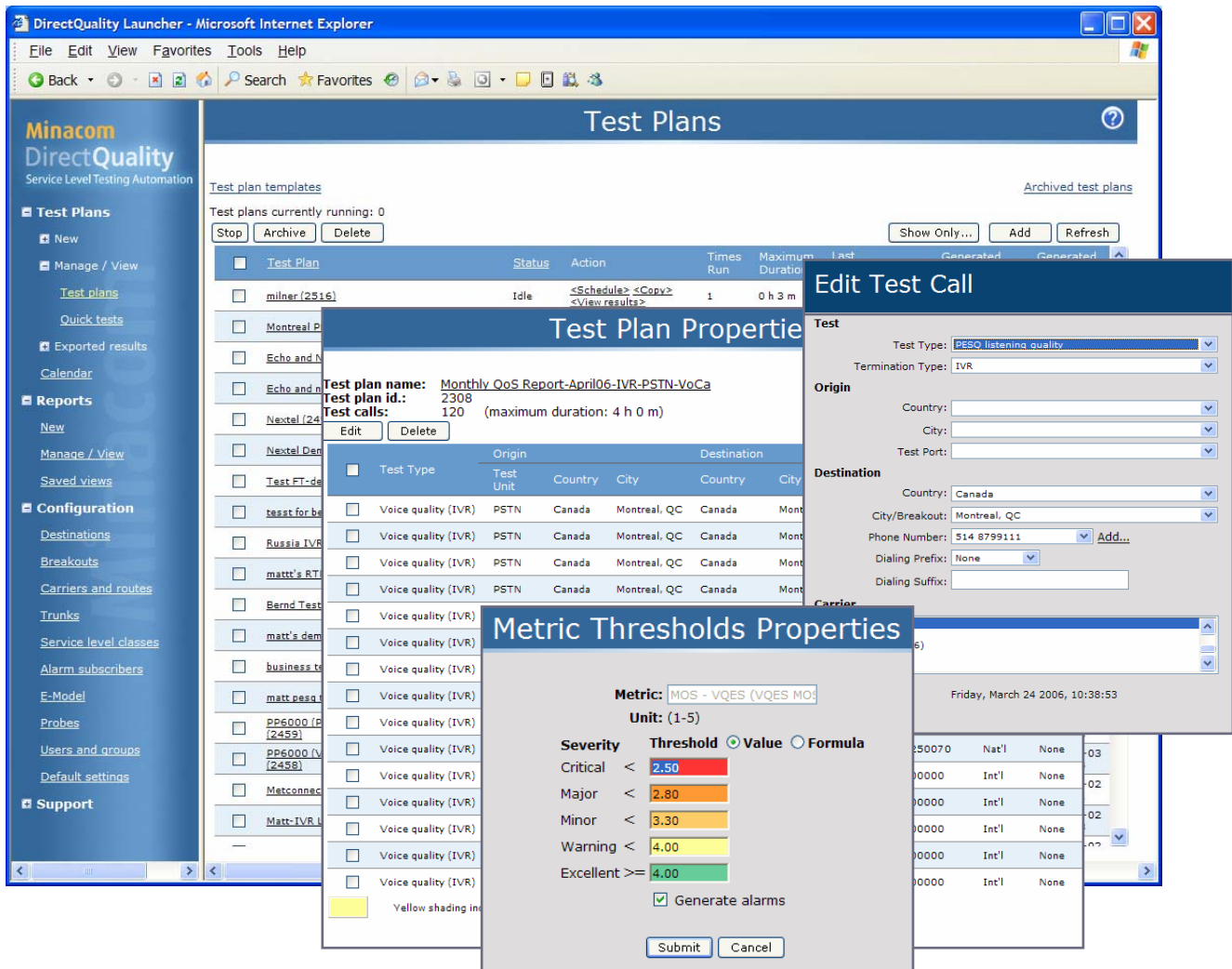


Figure 3 - Example of DirectQuality Test Management OSS & Service Level Class Thresholds

A best practice service assurance program consists of regularly scheduled test calls from Minacom's PowerProbe service level test probes located in the Network Operations Center (NOC) to PowerProbes located in hubs, complemented by tests to Tollgrade transponder eMTAs located at power supplies and silent loopback VoIP test calls to subscriber eMTAs located downstream from each power supply. Results are then classified and compared to confirm and isolate service degradations. Because the eMTAs in Tollgrade DOCSIS-based transponders are controlled by the cable operator and are located in the coaxial outside plant, performance quality thresholds can be set to identify trends before the service quality issues become customer-affecting.

DirectQuality R7 remote testing to Tollgrade Cheetah transponders is a highly cost-effective monitoring method, as it provides unrivaled testing depth and visibility and complete HFC test coverage without the significant capital and operational expenses normally associate with large-scale test system deployment.

MTA Speech & DTMF Loopback Agent Metrics

Speech Quality

- PESQ LQ MOS
- VQES MOS
- Unsatisfied Users Ratio
- Speech Power
- Speech Loss
- Speech Distortion

Fax Tone Detection

- CNG Tone Detection
- CNG Tone Duration
- CED Tone Detection
- CED Tone Duration

Voice Path Delay

Frequency Response

- Loss (1100Hz, 2100Hz)
- RSL (1100Hz, 2100Hz)

VoIP Transmission

- Frame Muting Ratio
- Comfort Noise
- Clipping Events
- Total Clipping Duration
- Average Clipping Duration
- Maximum Clipping Duration
- Proportion of Front-End Clipping
- Front-End Clipping Events
- Average Front-End Clipping Duration
- Proportion of In-Between clipping
- In-Between Clipping Events
- Average In-Between Clipping Duration
- Proportion of Back-End clipping
- Back-End Clipping Events
- Average Back-End Clipping Duration
- Hang-Over Events
- Average Hang-Over Time

Network Timers

- Dial Tone Delay
- Post Dial Delay
- Billing Duration
- Call Duration

Connection Status

- Call Disposition Code
- PRI Cause Value
- PRI Cause Location

Noise

- C-Message Noise
- Wideband Noise
- C-Notch Noise
- Gain
- SNR

DTMF Detection

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About Minacom

Minacom builds Service Level Test Systems for Telcos and Cable MSOs, and Internet Telephony Service Providers. Minacom's automated test systems help maintain the integrity and quality of large-scale multi-service deployments, including Voice, VoIP, IPTV, Caller ID, Voicemail, Conferencing, Fax, Dial-Up Modem, Video Conferencing, and IP Services from Ping and DNS to Audio & Video RTP Streaming.

Minacom systems are web-controlled by a centralized server platform that integrates years of operational experience into test setups, test strategies and result analysis rules of which over 70 operators worldwide are taking advantage of everyday. Experience Minacom's QoS test automation live at www.minacom.com/try.

About Tollgrade

Tollgrade Communications, Inc. is a leading provider of network service assurance products and services for centralized test systems around the world. Tollgrade designs, engineers, markets and supports centralized test systems, test access and status monitoring products, and next generation network assurance technologies for the broadband marketplace. Tollgrade's customers range from the top RBOCs (Regional Bell Operating Companies) and Cable providers, to numerous independent telecom, cable and broadband providers around the world. Tollgrade's network testing, measurement and monitoring solutions support the infrastructure of cable and telecom companies offering current and emerging triple play services. Tollgrade, headquartered near Pittsburgh in Cheswick, Pa., and its products and customer reach span over 200 million embedded access lines, more than any other test and measurement supplier. For more information, visit Tollgrade's web site at www.tollgrade.com.

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