

DSL and IP Services Performance Testing



DSL Data and IP Services Qualification, Provisioning and Performance Testing

DSL deployment continues to accelerate throughout the world as service providers strive to quickly sign up as many customers as possible to head off competition from alternative broadband suppliers. The concern is that once a consumer is lost for broadband they may be lost for all services, including voice. Ongoing support costs must also be minimized as the deployment of DSL lines, and new services such as IPTV and VoIP, expands throughout the network. Tollgrade's Celerity® product line helps the service provider address these needs by providing a complete set of DSL testing solutions. These solutions are available today with Celerity, currently being used for qualification and service assurance for 60 million broadband lines.

Complete DSL Lifecycle Solution

The Celerity product line is used in all phases of the DSL life cycle: from marketing, sales and provisioning through installation, customer service and up selling. Ongoing benefits are also realized when higher speed qualification and performance testing are needed to support new service speeds and applications.

Unique, Patented Technology

Celerity copper line test applications gain access to the copper loop through the standard voice switch test bus. There is no need for expensive re-wiring of circuits for either pre-qualification or in-service testing. Celerity can test through test access matrices as well for non-switched lines such as G.HDSL or unbundled loops.

One Test Head

All Celerity applications use a single measurement unit deployed in the exchange. The LDU 50 need only be deployed once to support broadband testing needs from qualification through service assurance. The flexible design of the LDU 50 ensures that today's test requirements are met with a single test head while providing a platform to solve tomorrow's needs.

Celerity Benefits

Celerity SQ:

- Qualify millions of lines every week
- Speed binning for support of multiple tier offerings

Celerity SP:

- Real time, on-demand qualification and provisioning tests
- Identify service-affecting conditions (noise rejection, home wiring, etc.)

Celerity XS:

- Verify that the proper equipment has been installed and unwanted equipment is not present



Celerity XS – eXtended Signatures

Celerity XS software license provides the capability to detect equipment signatures, termination signatures and loop signatures that specifically affect DSL performance. These signatures can indicate conditions that are necessary to support DSL or affect DSL performance. Common elements in the network that can be signaturized and detected are:

- Central office equipment - CO splitters
- Loop equipment - load coils
- Termination equipment - CPE splitters, DSL incompatible equipment
- Cable - quad cable characterization, cable model differentiation, gauge approximation

Signature detection can apply to DSL qualification, provisioning and service assurance processes.

For qualification, identifying DSL-affecting signatures in advance of customer commitment provides an indication of the conditioning work required to put a line in service. Customers can be intelligently notified of the timeline and work required when ordering the service.

For example, the illustration below shows the broadband qualification results for a specific line. The second and third results summary lines, Customer Termination and Exchange/ Cable equipment, represent part of the Celerity XS analysis for the line. In this case, the characteristics of the line support a high-speed data service and basic video service, but a higher rate video service is unlikely to work without further grooming.

Results Summary				
	Service	Data 1	Video 1	Video 2
XS Result	Cable Insulation Fault	✓	✓	✓
XS Result	Customer Termination - Signature	✓	✓	?
	Exchange/Cable Equipment - Signature	✓	✓	?
	Signal - Customer Wiring	✓	✓	✓
	Signal - Cable Length/Loss	✓	✓	✓
	Noise Rejection	✓	✓	✓
	Qualification	✓	✓	✗

Line Condition Summary	
Cable Insulation Faults: None	Customer Wiring: 85%
Customer Termination: NT1	Noise Rejection: 56%
Equipment Signature: None	Celerity Loss: 43 dB
Length: 2220m	

Prior to a customer self install, provisioning verification can be performed to ensure that splitters have been installed and the loop is ready for DSL service, reducing the number of installation failures and resulting trouble calls and dispatches.

The service assurance process requires that equipment and terminations be identified when trouble reports are received. Identifying equipment, termination and line signatures completes the picture of the network's condition.

These signature detection capabilities are enabled by patented LDU swept frequency techniques, which maintain fast test times while providing measurements that expose copper conditions and the presence or absence of DSL enabling or impairing equipment.

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Celerity SQ – Service Qualification

Celerity SQ provides accurate single-ended pre-qualification of all copper loops in the network, creating a database that bins each line according to its DSL speed or service capability. Celerity results support call center sales and targeted marketing, reducing false greens and false reds, ultimately increasing customer satisfaction, revenues and profit margins.

Celerity uses a unique, multi-patented approach to qualify lines using fast, swept frequency analysis for the purpose of detecting faults or impairments to service performance and service/speed binning. To gain access to all lines in the network, measurements are made through the voice switch test bus, or alternately can be made through a test access matrix. Lines are tested using the Celerity routine feature, which automatically sequences through all lines in an exchange.

Lines can be qualified according to their service capability. Celerity provides the following information per line:

- Service bin – qualification statement for Internet data and video services
- Signal level (loss) – patented single ended technique approximating double ended loss measurement
- Home wiring influence – excessive inside wiring relative to shorter lines used for video services
- Noise rejection – ability of a line to reject interference from neighboring lines in the same cable bundle

The table shows some of the information provided by Celerity SQ and is an example of how a service provider can use Celerity results to characterize the network for its capability to support multiple broadband services. This information can be used to effectively plan and implement targeted marketing and sales efforts as well as equipment deployment for specific service speeds and service types (e.g., IPTV).

Directory Number	Line Length	Celerity Loss	Impairment Analysis	Data 1 Service	Video 1 Service	Video 2 Service
8364720001	3240 m	38 dB	Tested OK	Qualified	Qualified	Qualified
8364720002	1580 m	49 dB	Imbalance	Disqualified	Disqualified	Disqualified
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8364729998	5800 m	56 dB	Excess Loss	Qualified	Qualified	Disqualified
8364729999	1860 m	20 dB	Tested OK	Qualified	Qualified	Qualified

False Reds

Celerity SQ reduces false reds; lines previously thought to be incapable of supporting DSL but could in fact support service. Celerity has been proven to recover up to 35% of lines previously disqualified by other existing approaches.

False Greens

Celerity SQ reduces false greens; lines incorrectly classified as being ready for DSL but in fact are not. Celerity reduced the number of false greens by 4% in field trials.

SQ Outputs

The results of Celerity SQ are stored in a data warehouse for integration with service providers' flow-through provisioning processes, targeted marketing campaigns, etc.

Celerity SQ can be combined with Celerity XS to identify DSL enabling or DSL impairing equipment and terminations.



Corporate Headquarters
493 Nixon Rd
Cheswick, PA 15024 USA
+1 412 820 1400 | 1 800 878 3399
www.tollgrade.com

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