Automated Copper Loop Testing for Broadband and Voice Services Support
Advances in voice and data transmission technologies have significantly changed the telecommunications industry. However, efficiently maintaining the copper plant is still one of the primary business concerns for telecom service providers. The deployment of new services such as IPTV and VoIP, and transmission technologies such as DSL, place even more stringent transmission requirements on the network’s copper segment. The cost associated with maintaining the copper plant is among the largest service providers face. The aging plant, and the need to carry ever more complex services over the existing copper, requires significant field-related efforts. Simultaneously, competitive pressures continue to drive down the per-line revenue for voice and data services, increasing the importance of reduced maintenance costs. Voice and data services maintenance must also address increasing competitive and regulatory pressures to reduce repair times and increase quality of service (QoS).

Services Testing Solutions
While copper loop testing has improved considerably, many service providers still rely on built-in test systems that can be controlled, automated test systems such as Tollgrade’s 4TEL and LDU 50 address these issues while reducing cost and repair time and increasing QoS. New service offerings like IPTV and increasing data rates require testing solutions that are effective for current services and capable of supporting new ones. A centralized, automated test system such as Tollgrade’s 4TEL and LDU 50 address these issues while reducing cost and repair time and increasing QoS.

One Touch
When responding to a consumer trouble report, the service provider’s primary goal is to resolve the problem in as little time as possible. Any subsequent need for the consumer to contact the service provider, or to be passed along to another individual or department, creates dissatisfaction, delay, and additional cost. Traditional trouble-handling procedures often require multiple touches by the consumer before the problem is resolved. With Tollgrade’s 4TEL, a test can be initiated at the consumer’s first point of contact, giving the Tier 1 representative the information to quickly identify the root cause of problems. By regularly testing all lines in the network, service providers can proactively identify faults and degrade lines, resulting in reduced call center costs.

Scalable Solution
In addition to the LDU 50, the 4TEL system includes the Test System Controller (TSC). The TSC is an industry-standard platform that provides interfaces for the service provider’s support personnel and Operations Support Systems (OSS). Each TSC supports testing and results analysis and archives data for up to one million assigned lines. For larger networks, multiple TSCs seamlessly network together for total test coverage.

The LDU 50 accesses each copper loop via the test access facilities of the switch or through a Test Access Matrix (TAM). Each LDU 50 is capable of performing the necessary measurements to support broadband deployment and service assurance as well as traditional voice service assurance.

4TEL/Celerity Benefits

Testing:
- Service assurance traditional PSTN/broadband
- Broadband qualification for service speeds (1.5 Mbps/1 Mbps) or service types
- Broadband provisioning
- Identify DSL-specific signatures

Operational:
- Reduce call handling times
- Faster test call
- Increased deposit/repair efficiency
- Accurate broadband qualification
- Real-time service provisioning verification

Users:
- Natural language dispatch statements
- Detailed measurement results
- Service qualification summary
- OSS integration

4TEL Tests

DT – Demand Test
4TEL DT is a comprehensive suite of tests that characterize the line from the exchange to the premises termination. Measurements are made between each leg of the pair, from each leg to ground, and from each leg to office battery. Specific measurements include:
- Parametric Measurements
- AC and DC Volts
- Resistance (metallic faults)
- Capacitive-Ringers
- Admittance, including Conductance and Susceptance
- Cable Length
- Cable Balance
- Line Terminations
- Electro-mechanical Ringers
- Electronic Ringers
- Other Premise Equipment
- Receiver Off Hook
- Basic Equipment Signatures

Results are presented in a natural language dispatch statement that provides an easily understood, high-level test summary. The dispatch is available quickly, allowing call center personnel to verify customer-reported problems immediately and includes the information necessary to schedule repair actions. If unusual conditions are present, detailed measurement data is available for use by a technical expert to further analyze the problem.

RT – Routine Test Option
4TEL RT pro-actively tests each line in the network on a regular basis. Known as routing, this allows service providers to schedule automated testing for the lines in an exchange. By adding routing capabilities in the 4TEL DT measurement and analysis platform, all or a subset of lines in each exchange can be scheduled for testing. Routines can be configured to start and stop at times to avoid other testing activities, so that results will be available for analysis when needed.

By regularly testing all lines in the network, service providers can proactively identify faults and degrading lines. Routing results can be used to identify multiple faults in common network equipment. Regular, timely identification of copper loop problems can reduce costs by increasing repair efficiency, and early identification of problems can increase customer satisfaction. Test results are archived on the TSC and are used to create advisory reports, which identify lines requiring attention.

XT – eXtended Test Option
4TEL XT extends the capabilities of the basic demand test by giving the user an additional level of troubleshooting tools. The Tier 2 or field technician can now perform diagnostic testing that identifies service impairments that normally can’t be addressed by a single demand test. These types of impairments often occur with degrading or intermittent line conditions or can be a result of consumer equipment problems. 4TEL XT adds the following capabilities to those available with the demand test:
- Repeat Testing
- Pair ID Tone Generation
- Continuous Testing
- Ring/Talk Monitor

The 4TEL XT option also includes batch testing capability. Batch testing allows a specific set of lines to be scheduled for demand tests. Batch testing is often used to verify copper loop integrity after significant network changes have occurred; for example, when a cable cut has been repaired or a new carrier system deployed.

4TEL II Option
4TEL II performs advanced expert system analysis on demand test results to increase dispatch effectiveness. Multiple sources of information are evaluated to help guide the repair craft to the right locations, including:
- Repair information (phone-out) from millions of historical tests
- Customer Trouble Reports (CTR) symptoms
- Known good “foot print” reference for line under test

Celerity – DSL Qualification, Provisioning, and Testing

Celerity XS – eExtended Signature Option
Celerity XS identifies the line’s DSL-specific characteristics, such as the physical equipment attached to the line and the line’s transmission characteristics. These ‘signatures’ provide basic indicators of the line’s DSL readiness. Exchange splitter detection aids in the provisioning of broadband service by verifying the correct installation of the device. Load coil identification allows pro-active scheduling of grading activities as well as verification of non-loaded status as service provisioning activities are completed. Celerity XS also looks for broadband service impacting transmission characteristics by analyzing the measured cable construction for the effects the loop might play in having high speed services.

Celerity SP – Service Performance Option
The Celerity SP test provides a real-time broadband performance qualification. Line performance is evaluated against service speed(s) or service type(s). Celerity SP analysis uses measurements of the line’s broadband transmission capability (e.g., signal loss, susceptibility) to report on the impact of existing premises wiring to determine the qualification status for the line. This option can significantly benefit the broadband sales, provisioning and service assurance processes, allowing new service commitments, for specific service speeds or types, to be made with confidence. And the line’s performance can be conveniently verified prior to field installation.
to and after service turn up, as well as at any future time where the performance characteristics are in question.

**Celerity SQ – Service Qualification Option**

Celerity SQ uses the qualification analysis of the service performance test to determine the broadband capability of every line served by the exchange. Scheduled routining allows for bulk testing during off-peak hours while ensuring that all lines are regularly tested to identify changes. Celerity SQ provides a network-wide view of service qualification, making possible targeted marketing of service speeds or types, and cost-effective equipment deployment.

**Configuration Guidelines**

Tollgrade’s 4TEL product scales to support millions of access lines. Each TSC supports up to 50 simultaneous tests for 1 million defined access lines, in up to 200 separate exchanges. LDUs are typically deployed as one per 5,000 lines for service assurance applications, or one per 25,000 lines for qualification purposes.

**System Interfaces**

**Voice Response System**

The 4TEL Voice Response System (VRS) provides field technicians with dial-up access to the testing system using a DTMF handset or cell phone. Complete demand testing and interactive fault location is provided for directing the technician to the location of faults. VRS can also be used to generate a pair ID tone on the line under repair to help identify that specific pair in the field.

**Test Interface Library (TIL)**

Tollgrade’s TIL is used extensively in deployed systems as a convenient machine-to-machine interface for service provider OSS integration.

**Standards Compliant Open Interfaces**

4TEL also supports commonly used open interfaces, such as CORBA. For users who prefer web browser access into the system, a web services interface is also available.

**Professional Services**

4TEL products can be delivered as turnkey solutions. The software is backed by a world-wide professional services organization offering pre-sales support, installation, project management, helpdesk support, customization, and on-going system management and improvement through software maintenance.

**Tollgrade. Service Assurance Simplified.**

With over 20 years of experience in network assurance, trust the experts to help you improve operational efficiency and customer satisfaction.

Tollgrade operates globally with U.S. offices in Pittsburgh, Pennsylvania and Piscataway, New Jersey and European offices in Germany and the United Kingdom. For more information, contact Tollgrade at +1-724-720-1400 or via the web at www.tollgrade.com.

Comprehensive line testing for emerging broadband and legacy networks.