# Malden MultiDSLA

A new generation of network and equipment test system delivering professional standards of measurement across a wide range of applications.

Malden Electronics
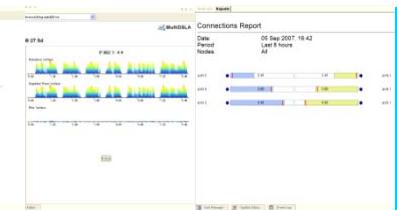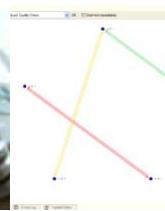
WHAT IS IT?

A professional test system which measures the end-to-end *user experience* of any telephone system.

Outstanding performance/cost ratio

Short learning time

Flexible and scalable architecture

Unattended or manual operation

Wide range of applications

MultiDSLA

Multi-node

+ Multi-test

  + Multi-user

= Scalable for any application

BENEFITS

MultiDSLA provides reliable standards-based data for:

Service Level Agreements (SLA)

Fault-finding / diagnostics

Benchmarking

Trend monitoring

From the laboratory to the network, from high-level performance statistics to detailed diagnostics: MultiDSLA is the trusted solution for all speech performance requirements.

The Business Case for Network Performance Measurement

Voice communications systems delivering poor or erratic quality of service can have a significant negative impact on corporate image, customer satisfaction and employee productivity.

Voice/data convergence, packet transmission techniques and the use of compression codecs can all bring cost benefits which are too easily lost when performance is not optimised. MultiDSLA equips you to manage Quality of Service, powerfully and effectively.

Trusted Malden Electronics measurement know-how is now delivered in a versatile system which combines powerful network-wide testing with simple to use management tools. For the first time, the Network Manager has the power to identify voice network performance parameters which truly represent *users' experiences*. Users know when they are not satisfied with quality of service but often cannot articulate usefully about the speech quality they experience.

MultiDSLA is a scalable solution for the measurement of network speech transmission performance to meet the needs of Corporate Enterprises, Network Operators, Service Providers, System Integrators and Equipment Developers.

MultiDSLA is a versatile system which combines powerful network-wide testing with simple to use management tools. For the first time, the Network Manager has the tools to assess voice network performance in a way which truly represents users' experiences in large or small networks.

MultiDSLA sets up calls and makes measurements between any end points in the voice network. Tests occur according to a pre-defined schedule or on demand with a simple to use graphical representation of the network. Comprehensive speech performance testing has never been this quick, simple and free of test design errors.

MultiDSLA is a revolution in voice network management which delivers objective performance data.

- Modular, scalable architecture
- Fast set-up and deployment
- Top-level management reporting
- Local and remote operation
- Full detail drill down to core measurements and analysis
- Meaningful *real world* assessment of performance
- Dedicated or shared control
- Simple integration into existing management systems
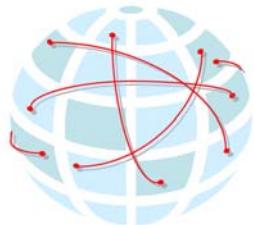
Product Overview

MultiDSLA – a new generation of network and equipment test systems incorporating the best features of the two channel DSLA and adding many new capabilities. MultiDSLA offers unrivalled ease of use and will perform the most complex test processes.

- Controls many endpoints or nodes simultaneously including analogue, VoIP, ISDN BRI and PRI nodes
- Measurements can include uncontrolled endpoints such as Conference Bridges, PBX and IVR systems
- Generates any speech at any level through any node
- Measures speech level, noise, delay and speech quality
- Generates and analyses DTMF sequences
- Summarises Results and drills down to the details of a single measurement
- Completely characterises network or device performance
- Sophisticated Test Manager controls the automation of network testing for different users
- Task Editor creates and configures tests
- Can be controlled remotely with MultiDSLA Remote User - see separate leaflet.

LAB	ENTERPRISE	NETWORK	ON THE ROAD	MANUFACTURING
• Interactive test creation	• Management Reports	• NMS integration	• GPS for location and synchronisation	• Repeatable testing
• Fully flexible test design	• Unattended operation	• Central scheduling	• Low power requirement	• No training to run a test
• Highest accuracy	• Small learning curve	• Central maintenance	• Interface to cell phones	• Database of all tests
• Extensive analysis	• Alerts on problem	• Multi-tier user support	• Support for missing control network	• End of day reports
• Immediate feedback	• Standard tests	• Quick and easy to use		• TCL/Perl/Python remote access control
• Scenario testing	• Affordable and scalable	• Web reports		
• Test automation	• NMS integration			

MultiDSLA is used in all branches of voice communications. These are just some application examples:

Terminal development

Network element development

VoIP, cellular, TDM, analogue: all transmission technologies

Regression testing

SIP Phone test bed

Conference bridge testing

Wireless handset comparison

UMA performance and handover analysis

Speech quality optimisation in all speech networks

Vendor selection

Enterprise SLA validation

Speech quality/load evaluation

Echo simulation and cancellation analysis

Drive test GSM

Competitive comparison of cellular networks or terminals

Drive test PMR/Tetra

Train communications

Codec evaluation

DSP performance measurement

Test Methodology

To obtain the most comprehensive understanding of speech transmission performance it is necessary to run intrusive tests between the handset ports of telephone terminals, thus getting as close as possible to the user's experience of speech quality. This is important because many factors, including the performance of the terminal device (telephone, gateway, etc.), influence the user's experience, and 'end-to-end' measurement is the only way to take these factors fully into account. The Digital Speech Level Analyser (DSLAII) has two high quality analogue ports which connect to PSTN/PBX lines, the handset ports of telephone instruments, including IP phones, or at four-wire level. Distributing DSLAIIs around the network, under the control of the MultiDSLA application, offers the best available measure of end-user experience.

A VoIP Virtual Node (VN) can be used at strategic network locations as a reference SIP or H.323 phone. The VN is a software application which is placed at a node in the VoIP network and controlled by MultiDSLA.

Tests performed between a physical terminal and a VN can help to localise speech performance problems by effectively segmenting the speech transmission path. Calls between VN's can track performance changes in the infrastructure.

MultiDSLA brings a new concept in the evaluation of Conference Bridge performance. Many calls can be placed from the different types of nodes to the Bridge. Automatically, the speaker node rotates through each node with all the other nodes listening and measuring. The results build confidence in the Conference Bridge capability handling multiple codecs, protocols and analogue connections.

Tools for the analysis of DTMF signals, for speech filtering and equalisation and for detailed analysis of speech performance are part of system. The Performance Examiner provides essential information to codec and DSP developers as well as network integration engineers.

The Minimum Network Test System for VoIP comprises a DSLA and a pair of VN's. Calls between DSLA channels, perhaps connected via an IP Phone handset, will correlate well with the end user experience. Calls between VN's yield useful data about the capability of the network to support speech traffic under various load conditions. Calls from a VN to a DSLA segment the network to help identify problems and assess the effectiveness of solutions.

A more complex configuration might include ten DSLAs and 20 VN's distributed around key sites in the Enterprise; these nodes are constantly testing and reporting network performance. Configurable alarms identify when and where problems are emerging. Results analysis yield service level data to help control costs.

Alternatively, the more complex configuration can be employed in the development laboratory or System Integrator test facility to assess the performance of new designs, software releases or vendors. Evaluation of Conference Bridge performance, simulating many participants with different access networks, is simply achieved in the MultiDSLA user interface. Analysis of results by codec or access network is easily prepared.

MultiDSLA will scale to support many nodes. The limitation is only in the processing power of the PCs running the application, SQL server and Metrics Processor. A large Enterprise network might include 200 sites around the world with one or more nodes at each site. Several MultiDSLA applications can reserve access to the nodes for different purposes at different times. Key operations personnel can override reservations and take over resources to address immediate issues. Day-to-day measurement programmes continue as background tasks providing assurance that service level agreements are being met and that end-users continue to experience good quality communications. Trend reports, by node or by group of nodes, show the onset of service deterioration in a particular area before it becomes a crisis. Detailed analysis and focused testing will help fault diagnosis, repair and service restoration.

Initiating a Test

In its simplest form, a quick test is initiated when the user draws lines between the nodes on a screen. The test can be quick or lengthy, immediate or deferred, single or repeated. The user is prompted to specify the test process. Tests of great complexity can be defined in a few clicks of a mouse.

The MultiDSLA SQL database holds detailed information about each node in the network. The node information defines the network access to that node, so that when the user initiates a test the called node data is used to set up the call from the calling node.

One node can have many different configurations, for example; SIP or H.323, several codecs and various jitter buffer sizes for a VN node; local and international telephone number information, handset and IP phone number for a DSLA node.

Support for Conference Bridge evaluation includes simultaneous multiple network access definition along with user defined access code, PIN and waiting periods.

OBJECTIVE MEASUREMENT TECHNOLOGY

Objective speech quality testing is one of the few truly generic measurement technologies in telecommunications. From co-dec development to enterprises and from core technology providers to service providers - indeed wherever speech signals are processed or transmitted - the measurement of *speech performance* is essential.

USER FOCUS

Traditional measurements relate to concepts which are obscure to the user - examples are speech bandwidth and packet loss. These mean nothing to the average telephone user and may not even be relevant to the user's *experience* in making a telephone call. By contrast, MultiDSLA's objective speech quality measurement focuses on what is important to the human being, using the Mean Opinion Score (MOS) scale of 1 to 5 which expresses how users perceive speech quality:

1 - Bad

2 - Poor

3 - Fair

4 - Good

5 - Excellent

Tests made to and from the very edge of the network - where the user sits - ensure that the measurements really do represent the *user experience*.

EXTREMELY SENSITIVE

It is important to realise that the MOS scale is not limited to integer values. MultiDSLA returns values to two decimal places and so indicates even very small variations in performance - variations which individually may not even be noticeable but which may prove to be significant.

Results

MultiDSLA provides a comprehensive set of tools for the generation, management, display, remote viewing, logging, summary and detailed analysis of results.

Users have widely varying priorities for results. Developers typically require a critical and detailed view of many aspects of speech performance - this is provided by the MultiDSLA graphical results presentation and further enhanced by the Performance Examiner option.

Network operators typically require a statistical analysis, with emphasis on patterns of performance over different periods.

MultiDSLA allows the user to configure results presentation to meet specific requirements, selecting from a range of options for logging, setting limits, handling exceptions and generating alarm messages. Summary, Exception, Connection and Trend Reports are immediately available within the application or remotely over any convenient IP connection.

The new Perceptual Expectation Gap™ view of the speech quality between end points offers a convenient way to compare performance across different network technologies or against Service Level Agreement requirements.

Alarms

Parameters which can be assessed include listening quality, speech level, noise level, delay, delay variation and echo, as well as user-defined measures such as "post-dial delay". Thresholds can be set so that an "exception" occurs when a measurement is above or below a specified threshold. Exceptions are noted in the results database and can be reviewed for a selected range of nodes and a specified period of time.

The MultiDSLA user may define any number of alarms. Each alarm may specify up to three exceptions, a number of violations, a time interval and the node(s). An alarm can be signalled to the user by an automatic email transmission, and/or an SNMP message.

Alarms may be reset manually or automatically. Automatic reset occurs when the system considers that the alarm condition has been cleared. The alarm is then allowed to fire again when the alarm conditions are next met.

Managing and Planning Tests

MultiDSLA incorporates an advanced Test Manager. This is automatically programmed to initiate tests immediately or at regular intervals. Tests can be planned by users at particular times of day or at some frequency of recurrence out into the future. The MultiDSLA will reserve the resources and will start the tests even if the original user is no longer logged on to the system.

Resource reservation conflicts are flagged as soon as the Test Manager schedules the user's plan. The hierarchical user structure permits key users, such as Operational staff, to override less important user reservations.

Creating New Tests

The Task Editor creates and modifies the test processes so that different parameters of the network can be investigated more thoroughly. Connection Check, Quick Quality Check, Full Quality Check and Engineer Evaluation Tasks are included in the MultiDSLA application. These can be easily modified in the Task Editor to develop variations that will better characterise some aspect of network or equipment performance.

Pedigree and History

Originally launched in 1997 to meet the needs of the 'voice over data' revolution, the DSLA has been continuously developed and enhanced, evolving into DSLAII, a state of the art measurement system for speech performance assessment. The specialisation of Malden Electronics in this field has enabled it to respond rapidly to customers' requirements, resulting in a system of unparalleled precision, capability and flexibility. It has become the reference measurement system for many organisations in applications ranging from core technology development to network operations. MultiDSLA combines this same measurement technology with a very powerful set of management tools.

DSLA is used in the research, development, acoustic and test laboratories of telecommunication equipment manufacturers, supporting development and testing of VoIP, GSM, UMTS, DECT, TETRA/TETRAPOL and VoDSL terminals, media gateways, echo cancellers, integrated access devices, PBX equipment and telephone switches. DSLA is used in product evaluation and system selection laboratories as well as in the installa-

The concept of "end-to-end" measurement of speech performance carries with it the ideal of "perfect" test terminals, introducing no noise, distortion or delay. Whist a perfect test terminal cannot be achieved it is important to get as close as possible, since any degradations introduced by the terminals will affect the accuracy of measurement.

Desired measurement

Test node — NUT — Test node

Actual measurement
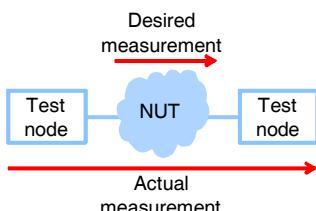
NUT – Network under test

The Digital Speech Level Analyser (DSLAII) and Virtual Node (VN) test interfaces have both been designed by Malden Electronics to meet stringent requirements, ensuring that users may regard the Multi-DSLA system as a reference for speech quality assessment.

MEASUREMENTS

Key performance indicators include:

- Speech quality score (ITU-T Rec. P.862 PESQ, narrow- and wide-band models)
- Received speech level (ITU-T Rec. P.56)
- Received noise level
- Echo level
- Delay and delay variation
- Post-dial delay
- Jitter, RTP & RTCP
- Packet loss, RTP & RTCP
- DTMF performance
- Call success rate
- Conformance to Service Level Agreement values (SLA)

tion, maintenance and Quality of Service (QoS) departments of network operators and service providers.

Malden Electronics technology enables the DSLA to generate speech signals at any defined level, and to measure mean active speech level, noise level, peak signal level and activity factor. In addition to speech level measurements and speech quality scores, DSLA offers key speech performance indicators in numerical and graphical form, essential for the analysis of distortions in the degraded voice signal caused by noise, codec distortion, voice activity detector (VAD) performance or network impairments such as delay, packet loss, jitter buffer behaviour and echo. MultiDSLA brings a new technique - the Perceptual Expectation Gap™ - to users to help understand the way different communications paths exceed or fall short of Service Level Agreements and design objectives.

Telephone, Handset and 4-wire Balanced analogue interfaces are incorporated into the two-channel DSLA terminal. These can be used alone or in conjunction with a variety of optional digital interfaces including ISDN BRI/PRI and SIP/H.323 test agents, providing a measurement capability between many types of physical and virtual network end points.

Specifications and Features

PC minimum specification:
1.4GHz Pentium Processor, 512MB memory, 1024 x 768 screen resolution, 10M Ethernet, Windows XP Professional, Windows Server 2003, Windows Vista Business or Ultimate (2GB memory recommended for Vista)

System Configuration

Test Nodes and Devices

DSLAII: Handset and Telephone Line ports. Two analogue Nodes.
VN: H.323/SIP Reference Soft Phone. Windows 2000/XP/Vista application. One Node.
ISDN BRI: Windows 2000/XP/Vista application. Two Nodes.
ISDN PRI: Windows 2000/XP/Vista application. 30 Nodes (E1), 24 Nodes (T1).
Phantom Node: Network Device with no MultiDSLA control and no measuring point. Used to represent IVR, PBX and Conference Bridge.

Support for VN

SIP/H.323. Codecs: A-Law, μ-Law, G.729A/B, G.723.1, iLBC, G.722

System Scaling

Nodes: 100's (depending on number of simultaneous tests required)

MultiDSLA Controller (User Interface application): – 1-32.
MS SQL Database: Can be configured to reside on the MultiDSLA Controller PC or on an independent server.

Remote User Access: Access from remote PC's via web browser - see MultiDSLA Remote User leaflet.

Minimum Network Test System (supports two simultaneous tests): DSLAII, 2 x VN, User Interface with PESQ, Performance Examiner, DTMF Analysis, Equaliser, Codec Library, Remote Report Access

Supported Standards

ITU-T P.56
ITU-T P.862, 862.1, 862.2

Pre-defined Tests

Connection Test – confirms the presence of a speech path between two Nodes.

Quick Quality Check – runs two speech quality tests in each direction.

Full Quality Check – assesses speech quality through several tests in each direction using a wide range of speech sounds and measures delay.

Engineer Evaluation – performs a thorough speech quality test using a wide range of speech sounds at different levels and measures delay and echo.

Reports – available locally through the Controller and remotely via a web browser interface.

In all reports the user can select the Nodes and time interval of interest

Summary - Histogram representation of principal measurements, with Pass/Fail indication

Exceptions – Listing of measurements which have exceeded user-defined thresholds

Connections – Graphical presentation of MOS and delay measurements between nodes, showing the Expectation Gap™.

Trend - Histogram representation of principal measurements showing trends over time.

Main Control System Utilities

Test and Reservations Manager – schedules and runs tests, reserves Nodes and flags conflicts.

Alarms Manager – sets alarm conditions and generates alarm outputs.

User Management – maintains a hierarchical password structure to set priorities and permissions.

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