MultiDSLA Application – Virtual Node for VoIP Test

This application note discusses VoIP performance assessment in diverse applications including VoIP Test in the Enterprise WAN and VoIP terminal assessment for IP phones, WiFi phones, VoIP gateways, etc.

Malden Electronics

MultiDSLA evaluates end-to-end user experience

WHAT IS THE VIRTUAL NODE (VN)?

The Virtual Node products form a family of VoIP test interfaces which work with the MultiDSLA test system. VN applications run on Windows platforms and provide the equivalent of a high-quality soft phone for testing purposes. There are three variants of Virtual Node:

VN – a single instance

***s*VN** – scalable VN, providing multiple VN instances on a PC at the same IP address, e.g. *s*VN10 = 10 instances

***d*VN** – downloadable VN, a transient VN instance which is downloaded from a network operator's web page to test a VoIP service at a remote end-point.

Applications of *s*VN and *d*VN are described in separate documents.

Virtual Nodes support SIP and H.323. In addition to G.711 A-law and μ-law, a codec library provides support for G.723.1 and G.729A & B and will soon be extended to offer a wide-band telephony option.

Virtual Nodes can be configured for frame size, jitter buffer size, network QoS support and in-band or out-of-band DTMF signalling, so that a range of sophisticated tests can be accomplished.

Virtual Nodes may be registered with a SIP proxy or may operate peer-to-peer.

Virtual Nodes working in SIP or H.323 can be registered as "telephone extensions" with enterprise IP telephony systems such as Cisco Call Manager.

Testing VoIP Performance

The emergence of VoIP as the future of telephony has offered the prospect of economy – whether through the rationalisation of network infrastructure or through toll-bypass – but it has left a trail of dissatisfaction amongst many users. Translating designs which appear to function perfectly in the laboratory into products for the real world can be problematic. Furthermore, the successful deployment of "perfect" network elements in a working VoIP system requires the expertise of system integrators and installers. Increasingly (and necessarily), these professionals come from a data background rather than a telephony background. Concepts such as "speech level" and "speech delay", central as they are to the perception of good quality of service, may be unfamiliar. There is a requirement for straightforward, reliable and thorough speech quality testing at all stages, in order to quantify VoIP performance and understand the nature of any problems identified.

What is important?

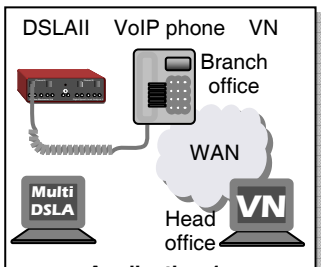
Both during development and in the field it is beneficial to measure VoIP performance in a way which relates directly to the experience of the user. Users after all do not generally talk in terms of "packet loss" and "jitter"; they talk instead of "low volume", "distortion", "noise" and so on. It follows that it is very important to make measurements at a point as close as possible to the user, and that these measurements should be standards-based and derived from a *perceptual* analysis of speech signals.

MultiDSLA with VoIP Virtual Node (VN)

The application examples below indicate some ways in which the MultiDSLA system with Virtual Node technology can be used to predict and understand the opinion of IP telephony users. All of these applications are within the scope of the MultiDSLA Minimum Network Test System, comprising MultiDSLA Controller, DSLAII and two Virtual Nodes. The Minimum Network Test System conveniently includes popular software options, including the Codec Library and DTMF Analysis.

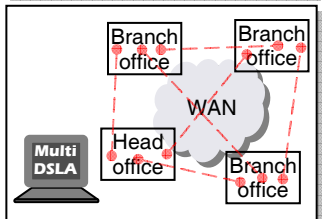
Application Examples – Enterprise VoIP

Application 1: Enterprise network with VoIP and analogue end-points. VN is used as a reference VoIP device at a strategic location, making calls to physical IP phones, soft phones, etc. The handset cord of the IP phone connects directly to the Handset port of DSLAII. PC sound card jacks may also be connected to the Handset port. This type of testing can be extended to assess the performance of inter-network calls - for example, by connecting a GSM handset to a DSLAII, the end-to-end performance of a VoIP–GSM call can be measured.



Application 1: Enterprise VoIP Test

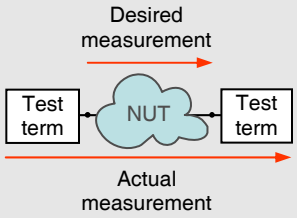
Application 2: "Any point to any point" testing across the enterprise network, between mixed VoIP and analogue interfaces. Here VN's and DSLAII's are used to perform concurrent tests between any combination of reference VoIP entity (VN), IP phone, GSM handset and analogue phone line. Making tests between pairs of VN's provides a benchmark of network capability which is independent of the performance of the IP telephony terminals and/or other gateway devices; these results can be compared with those for calls between pairs of IP phones. VN's may be used to assess the "VoIP readiness" of a network, and evaluate, for example, the trade-off between bandwidth ecomomy and speech quality for different codecs. These applications are easily extended to include testing of conference calls in which the parties access the conference bridge via analogue and/or VoIP.



Application 2: Testing Between Multiple VoIP & Analogue End-Points

THE NEED FOR HIGH QUALITY TEST INTERFACES

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.



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 MultiDSLA system as a reference for speech quality assessment.

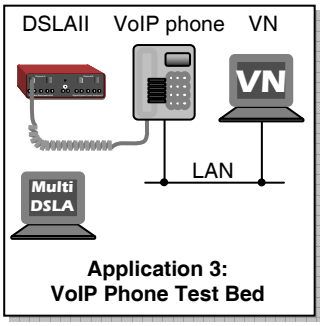
MEASUREMENTS

Key performance indicators include:

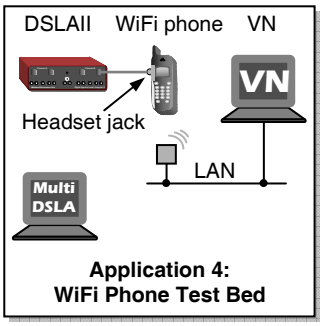
- Speech quality score (ITU-T Rec. P.862 PESQ, narrow- and wide-band models)
- Received speech level (ITU-T Rec. P.56)
- Received noise level
- Echo level
- Delay and delay variation
- Post-dial delay
- Jitter, RTP & RTCP
- Packet loss, RTP & RTCP
- DTMF performance
- Call success rate
- Conformance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

Application Examples – Product Development and Testing

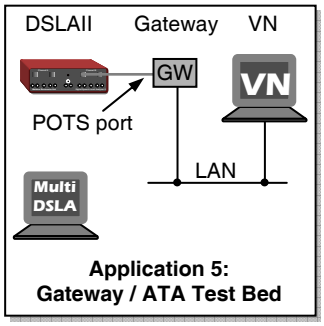
In a laboratory LAN with VoIP and analogue end-points, for example Applications 3, 4 and 5, below. A



Application 3: VoIP Phone Test Bed



Application 4: WiFi Phone Test Bed



Application 5: Gateway / ATA Test Bed

DSLAII provides analogue interfaces; VN provides a digital reference point in a clean network, against which a VoIP terminal or gateway can be tested by developers and Quality Assurance engineers. In all cases the MultiDSLA user interface controls the DSLAII and VN nodes and controls the test process.

Note that in Application 5, gateways with multi-channel interfaces (T1/E1 or greater) may be connected to a DSLAII via an analogue extension port of a PBX.

Results Analysis and Reporting

Requirements for results presentation range between the extremes of simple statistical analysis and detailled analytical data. VoIP transmission is a complex technology giving rise to many modes of degradation and failure. MultiDSLA has been designed for use by novice and expert alike, presenting measurements as simply or in as much detail as required.

Call Analysis

When a VoIP call setup fails this may be due to network configuration, poor network conditions, terminal incompatibility (including codec mis-match) or equipment failure. It is often necessary to look beyond the call success/failure ratio and investigate the signalling protocol itself. Packet monitoring techniques can be useful but the results can be confusing to the uninitiated. The MultiDSLA Call Analysis feature overcomes this problem by displaying a simplified sequence diagram showing the progress of the call, using absolute or relative times.

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