MultiDSLA Application – Wireless Handover

MultiDSLA is a new generation of network and equipment test systems delivering professional measurements across a wide range of applications.

Malden Electronics

MultiDSLA evaluates end-to-end user experience

THE IMPORTANCE OF PREDICTION

What influences wireless users' perceptions of the service provided by the network operator? Whilst customer service and tariffs undoubtedly play their part, it is the grade of communication which carries most weight. Noisy or erratic handover are disruptive to conversation and dropped calls quickly give rise to dis-satisfaction.

Handset and infrastructure manufacturers and network operators have a critical interest in handover per-formance optimisation.

Handover is a necessary feature of the mobile environment yet a "perfect" handover is not always possible. What are the para-meters affecting user acceptability? What are the thresholds?

Subjective testing provides accurate answers to these questions, but is a lengthy and expensive process. What is needed is a technique which predicts user acceptability by algorithmic means.

Such algorithms have recently improved to the point that the ITU has standardised one – ITU-T Rec. P.862, Perceptual Evaluation of Speech Quality (PESQ). When combined with a high quality instrumentation system, PESQ provides data relating directly to customers' experience.

These techniques are valuable at all stages in the design and test of wireless infrastructure because they provide reliable and repeatable numeric indicators of performance. They can be used to advantage during installation, commissioning and acceptance testing of wireless networks and in operational networks.

Wireless Handover

Good handover performance during a wireless communication is critical in providing a satisfactory user experience. Handover may be between cells of the same network or between different radio access technologies. The handover operation can be studied from the network perspective and from the terminal or user perspective. Whilst both techniques may be required, the measurement of the handover from the user's point of view offers two principal benefits:

The "handover effect" is measured in terms of the impact on speech quality; signal interruption time and changes in quality, speech level, noise level and delay can all be clearly seen.

The method works with all combinations of access network technologies. Intrusive measurement can be used to measure in GSM / GSM (cell handover), GSM / WLAN, WCDMA / WLAN, GSM / WCDMA and other technologies.

Intrusive assessment predicts the user's perception of handover performance.

What should be measured?

Measurements of interest before, during and after the handover include:

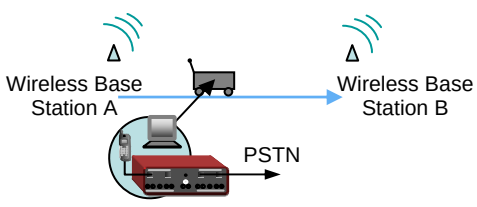
Speech quality	Speech level
Delay / delay variation	Survival of DTMF (e.g. IVR transaction during handover)

These measurements need to be considered in relation to those for the non-handover performance of each network. It may also be desirable to retrieve audio recordings of speech before, during and following the handover, for subsequent playback.

MultiDSLA predicts the user's experience of handover, either in an operational network or in a laboratory simulation. The system uses the ITU-T Rec. P.862 PESQ metric to estimate the speech quality on the Mean Opinion Score (MOS) scale of 1-5 (refer to side panel). MultiDSLA measures speech level in accordance with ITU-T Rec. P.56. Noise level, delay and delay variation are also measured. MultiDSLA interfaces to compatible GPS receivers, incorporating GPS time and position data into the results. GPS time can also be used to increase the accuracy of one-way speech delay measurement in cases where two MultiDSLA systems are used, for example in drive testing.

Test System Architecture – Laboratory

The simplest system consists of a single user interface application and a single DSLAII instrument. This is suitable for testing calls set up between a wireless handset and any other analogue termination at the same location, such as a second handset, PSTN or PBX line or the handset interface of a telephone set. This configuration can be extended by adding further analogue ports, ISDN BRI ports or VoIP interfaces (SIP or H.323) in any combination, supporting multiple simultaneous tests for side-by-side comparison of wireless handsets. The handover is forced either by physical movement of the test system between the base stations, or by gradually attenuating the transmitter power of one base station.



DELAY AND DELAY VARIATION

Measurement of average one-way delay, round-trip (end-to-end-to-end) delay and delay variation are possible in a MultiDSLA system.

Accurate measurement of one-way delay requires that the fixed and mobile terminals be synchronised. This can be achieved by connecting suitable GPS receivers to the terminals. A test script is constructed which begins the test process at the same time (t_0) at both the fixed and mobile ends. A test is typically composed of a number of stages; each stage is timed to proceed a defined time after t_0, ensuring correct co-ordination, even though there is no control channel linking the fixed and mobile ends.

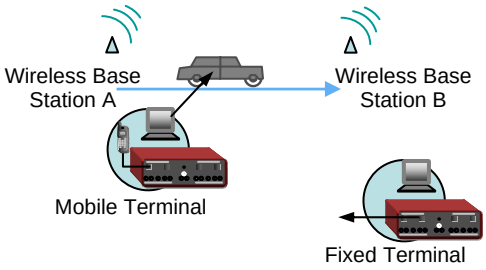
The GPS receivers must be models providing both a serial data output and a separate pulse per second output. Guidance on compatible types and interconnections is available on request.

Measurement of end-to-end-to-end delay can be accomplished without the use of GPS. A speech sample is sent from one terminal and then captured and recognised by the other terminal. The capturing terminal responds by sending another speech sample to the originating end. Since the response time is accurately known, the network round-trip delay can be calculated. In the absence of GPS synchronisation, the round-trip delay is halved as an estimate of one-way delay.

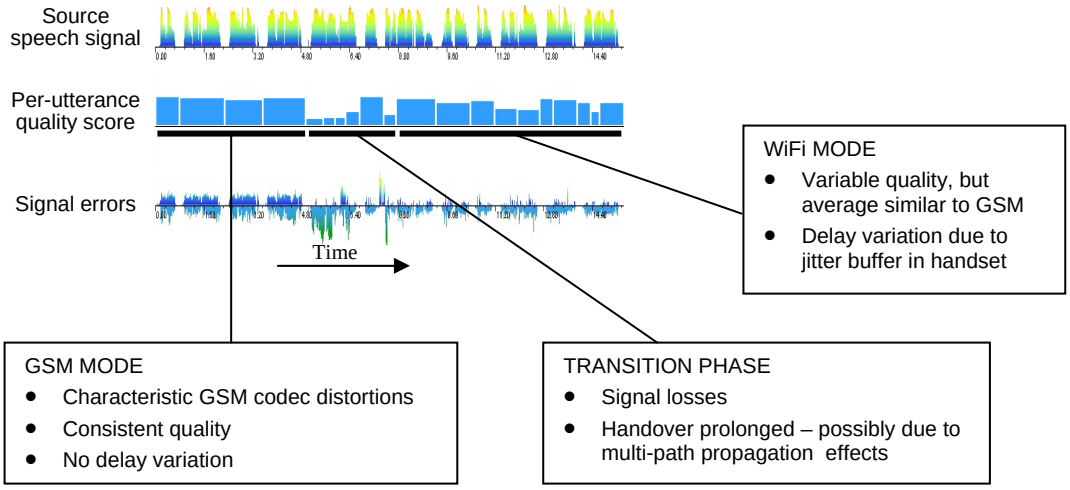
Delay variation is a feature of packet transmission and arises when a gateway jitter buffer is re-sized. The effect on speech quality can be minimal if this occurs in a silence interval but can be detrimental if it occurs during active speech. The PESQ algorithm measures the time offset between the reference speech samples and the captured degraded samples, and does this for each speech utterance individually. Thus MultiDSLA reports the maximum, minimum, mean, median and standard deviation of these measurements, providing a thorough analysis of delay variation.

Test System Architecture – Drive Test

A drive-test configuration consists of two or more inter-working systems – typically one at a fixed location and one in a vehicle. As in the laboratory application, the systems can be scaled to perform several simultaneous tests, involving one or more drive test vehicles. As the vehicle is driven over the test route, pre-scheduled tests run in a continuous pattern, results being stored in the MultiDSLA SQL database. Compatible GPS receivers can be connected to the fixed and mobile terminals to record location and enable accurate one-way delay measurements to be made. To facilitate the use of the DSLAII in a vehicle it accepts a 9-18Vdc power input at 12W.

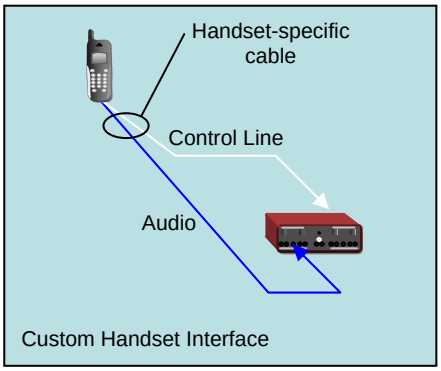


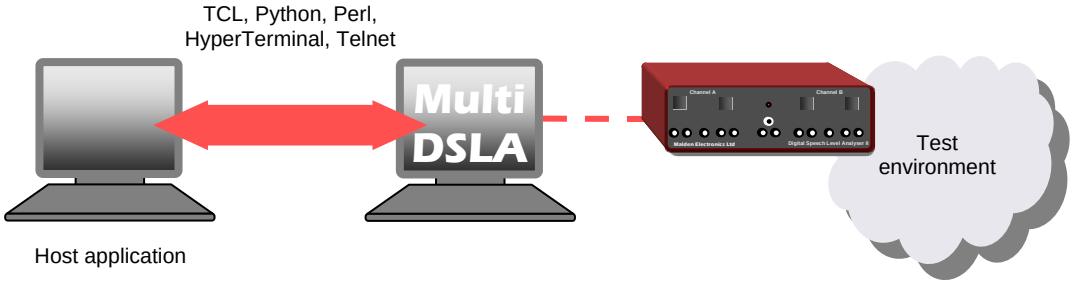
Results Interpretation - Dual-Mode Handset Before, During & After Handover



Test Customisation and External Control

The standard tests provided with MultiDSLA satisfy many general applications. Specialised applications such as handover analysis may require custom tests in which the engineer configures test direction, duration, repetition and so on. These can be created easily though the intuitive Tasklist Editor which gives access to a large number of powerful script events. Control Line ports are provided to enable automatic call control functions with many types of wireless handset. Remote Access supports remote control from another Python, Perl, TCL or HyperTerminal/Telnet test management system. In this case, the MultiDSLA user interface can be run minimised.





Malden Electronics

t: +44 (0) 20 8786 9145
f: +44 (0) 20 8393 6883
e: sales@malden.co.uk

Malden Electronics Limited
2 High Street, Ewell, Surrey
KT17 1SJ, England