Measurement of Delay Using DSLA

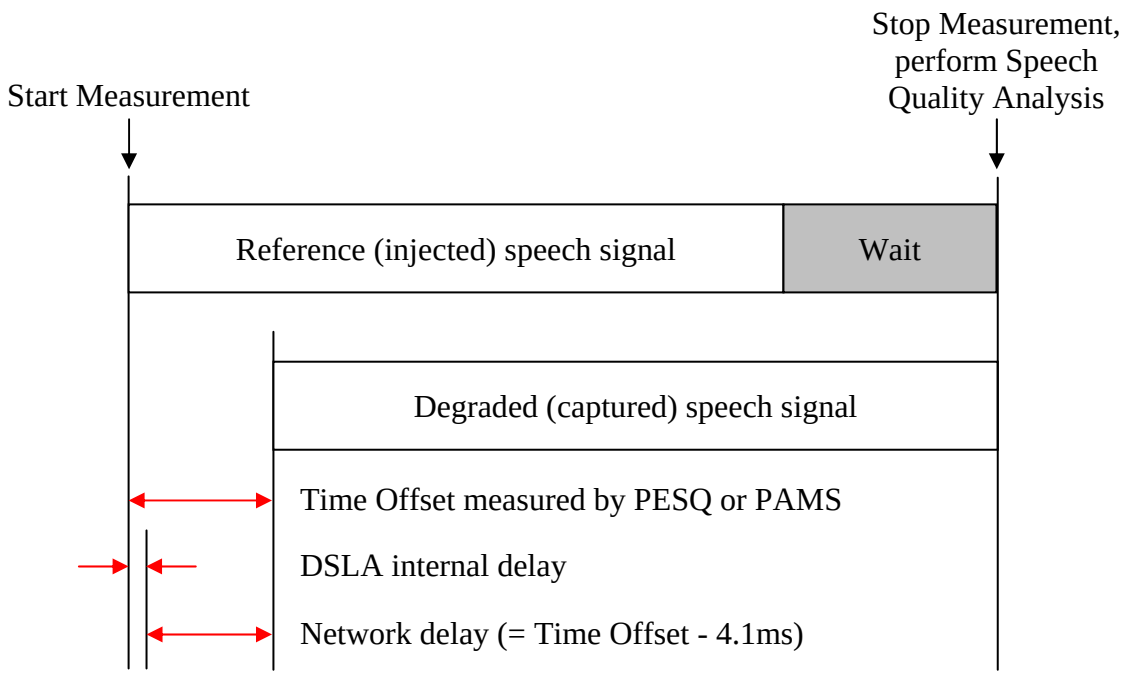

Fig. 1: Interpretation of one-way Delay from Time Offset measurement.

The DSLA system offers various methods for the measurement of speech delay in the network or system under test. The alternative methods and corresponding applications are summarised in the table below.

The DSLA can also indicate *variations* in delay, such as those occurring in VoIP networks due to variable packet arrival times. Both PAMS and PESQ employ a dynamic time alignment algorithm which is used to measure the delay of each speech utterance and detect delay changes occurring in silence intervals or during active speech.

DSLA interprets and reports the minimum, mean, median and maximum delay, and calculates the standard deviation of utterance delays. The range (max. – min.) and standard deviation are useful measures of the delay variation (jitter) observed in the received speech signal.

This data is also shown graphically as an Utterance Time Offset bar-chart.

Frequently-Asked Questions

Q: Does the DSLA measure one-way or round-trip delay?
A: A single DSLA measures one-way delay in the network connected between channel A and channel B. It can make separate measurements for each direction. Two DSLA's in Local / Remote configuration measure the end-end-end (round-trip) delay.

Q: The DSLA offers various methods of delay measurement. Which one is best?
A: In most cases the PAMS or PESQ time offset indication is the most accurate and robust method to use. The "Delay – Active Level" and "Delay – Time Align" methods were provided originally for instruments supplied without PAMS or PESQ. Also see the table below.

Q: Why can't I just use a 'ping' between two IP devices to measure VoIP delay?
A: 'Ping' reports round-trip delay of IP packets. This may be a valid assessment of delay for data packets, but

does not take into account the additional delay experienced by voice packets, including coding/decoding and jitter buffering. In order to accurately measure voice delay as experienced by the user, it is essential to make measurements using speech from one user terminal to another.

Q: Why does the DSLA system not compensate for the 4.1ms internal delay of the signal converters and filters in the instrument?

A: In a typical application, DSLA generates speech signals which are then passed through a network and captured at the DSLA's other channel. The total delay measured is the one-way delay of the network plus 4.1ms internal delay. However, the DSLA system can also be used to analyse pairs of reference and degraded speech files for speech quality, etc. In this case, the speech quality algorithm has no knowledge of how the signals were recorded and so measures and reports only the "time offset" between the files.

Summary of DSLA Delay Assessment Methods

Method	Application	Note	How to…
PESQ/PAMS time offset (Fig. 2)	Almost any, using one DSLA. When delay variation is to be measured.	Network delay = Time Offset – 4.1ms (see Fig. 1).	Time Offset measurement is made automatically when a speech quality analysis is performed.
Delay by Time Alignment (Fig. 2)	When speech quality is good but PESQ/PAMS not available or takes too long. When repeated "snapshot" measurements of delay are required.	Delay is measured directly and displayed in channel window and logged in the DLY column of results log file.	Refer to User Guide for playlist example.
Delay by Activity (Fig. 2)		Delay is measured directly and displayed in channel window and logged in the DLY column of results log file.	Refer to User Guide for playlist example.
Delay End-End-End (E3) (Fig. 3)	When two DSLA's are used in Local/Remote configuration.	Measures the delay from Local DSLA to Remote DSLA and back to Local DSLA. Compensates for DSLA internal delay and response time. Result is displayed in channel window and logged in the DLY column of results log file.	Refer to User Guide for playlist example; included in Quick Start schedule pairs Network Local…/ Network Remote…
Loop Delay (Fig. 4)	When two DSLA handset ports or VVT/ISDN and DSLA handset are used to measure across a network	Not suitable for measurement at a 2-wire analogue interface.	Set one end into Loop back and measure the Delay using any of the above methods. Divide Delay or (Delay-4.1) by 2 to obtain an estimate of one-way delay.
Loop Delay 2 (Fig. 5)	When two DSLA handset ports or VVT/ISDN and DSLA handset are used to measure across a network AND a reference network is available with known delay.	Not suitable for measurement at a 2-wire analogue interface.	Use DSLA in Route mode to return signal from the other channel where a second line is available and delay is known on that connection.

Fig. 2
- PESQ/PAMS Time Offset method with one DSLA
- Delay by Time Alignment method with one DSLA
- Delay by Activity with one DSLA

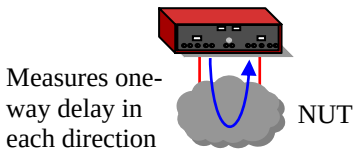

Fig. 3
- End-end-end method with two DSLA's

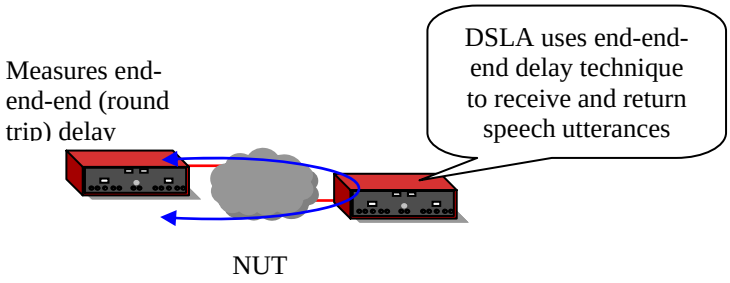

Fig. 4
- PESQ/PAMS, Time Alignment or Activity method with two DSLA's

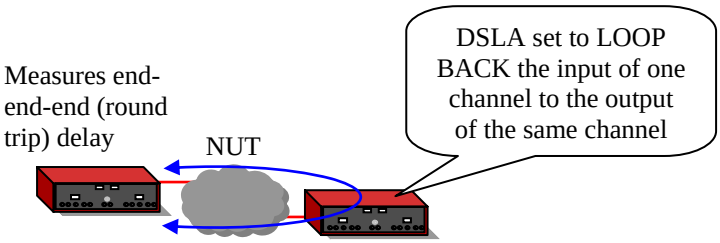

Fig. 5
- PESQ/PAMS, Time Alignment or Activity method with two DSLA's and reference network with known delay