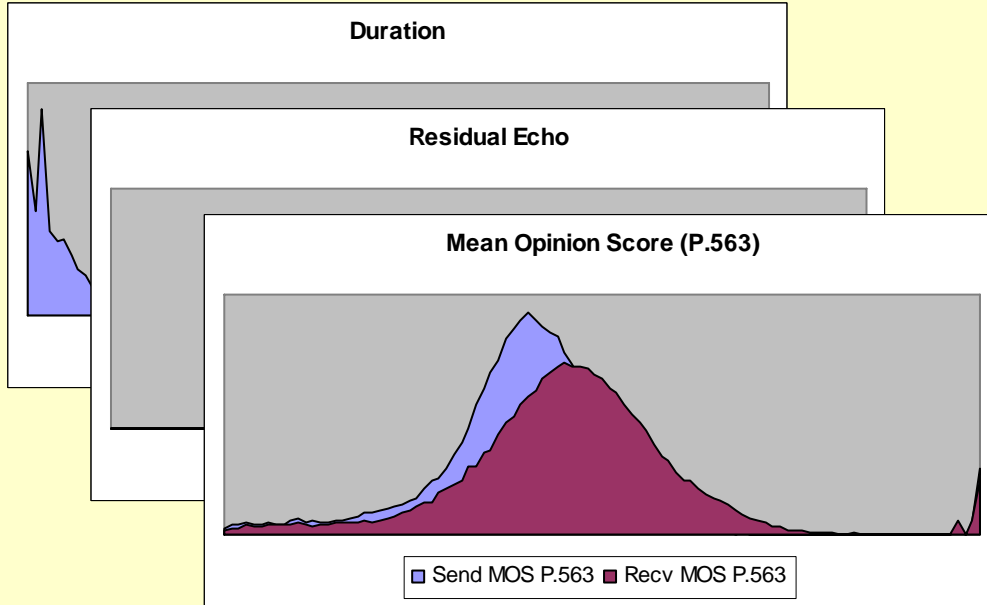


Benchmarking

Network Benchmark Prior To Major Upgrade



- **CUSTOMER:**
Tier 1 Network Operator
- **LOCATION:**
Australia
- **RESULT:**
Comprehensive data benchmarking the state of the network.

The Task

To benchmark the customer’s network from a voice quality perspective prior to significant network element upgrades.

The customer wanted to evaluate the success of a network upgrade from a voice quality perspective. A great deal of money was being spent with vendors to upgrade equipment that simply had to perform as claimed.

In order to verify the success of the upgrade it was decided by the customer that a comprehensive benchmarking activity should take place before the upgrade. Calyptech was approached because of its expertise in voice quality assurance and engaged to perform the benchmark.

The Procedure

Calyptech coordinated with the customer to position Beethoven Monitoring Points (MP100) around their network and a Beethoven Server (SE100) to gather and collate the data. The elements were placed in the network on a representative sample of the links in the part of the network scheduled for upgrade.

Over the course of two weeks tens of thousands of calls were rigorously analysed by the MP100 elements and the results gathered and collated by the SE100.

The Metrics

With Beethoven each call has over thirty voice quality metrics generated. With this information it is possible to determine the following:

- **Double Talk**—The amount of conversation in the call where both parties are talking at the same time. This may be an indication that the time it takes speech to arrive at the far end is too high causing fits and starts in the conversation to occur as individuals inadvertently talk over the top of one another.
- **MOS** - The Mean Opinion Score of the calls. This being an objective value based on the quality of the voice based on listening and conversational criteria. There are three types of MOS used in Beethoven; PESQ, P.563 and the E-model. All three

“With Beethoven benchmarking our network from a voice quality perspective was a breeze...”

judge the quality of the call from slightly different perspectives; PESQ against a reference file, P.563 from the listener and E-model from the network.

- **Echo** - The volume of echo coming back and the time it takes to come back. These are two distinct characteristics of echo that can combine to turn an ordinary telephone conversation into a very confusing and annoying event.
- **Clipping** - The amount of the call that was distorted by the network due to excessive volume. Clipping is expected on overly loud portions of speech such as shouting but when found in regular conversations it indicates a profound error in the setup of the network.
- **Noise Levels** - The amount of background hiss that the subscriber hears. If this becomes too large it is difficult for the subscriber to tell what the person on the other end of the call is saying. They have to concentrate hard to discern the words.
- **Speech Levels**—The volume of the speech of the subscribers. If the network does not apply the right amount of amplification to a conversation subscribers start to shout in order to be heard or whisper when told by the other party that they are too loud. The speech level needs to be set to a value that allows for a natural conversation to be held.
- **Duration** - The lengths of the calls made. This measurement turns out to be an excellent indicator of the health of a network. If the call duration suddenly drops on a network you can be sure it is because the subscribers are having a hard time talking to each other and subsequently are limiting their conversations to the bare facts. Conversely if the duration of the conversations goes up they are having a better user experience.

The Data

An example of a representative set of values obtained from the benchmarking is shown in the table to the right. The table shows the benchmark means and standard deviations for the duration of the benchmarking activity. Beethoven records these figures not only over the entire duration but down to the granularity of minutes and then against every call. It is even possible to compare voice quality metrics on a per subscriber basis.

Measurement	Mean	Stdev
Double Talk (%)	0.06	0.02
Near Echo Path Delay (mSec)	263.11	11.69
Far Echo Path Delay (mSec)	26.58	35.93
Near Echo Return Loss (dB)	33.07	8.91
Far Echo Return Loss (dB)	36.09	10.75
Send MOS E-Model	3.45	0.35
Recv MOS E-Model	4.18	0.49
Send MOS P.563	2.62	0.44
Recv MOS P.563	2.86	0.53
Send Speech Level (dBov)	-28.45	6.58
Recv Speech Level (dBov)	23.83	10.06
Send Muting (%)	1.46	2.92
Recv Muting (%)	0.58	1.56
Send Residual Echo (dBm0)	-72.65	11.66
Recv Residual Echo (dBm0)	-71.57	12.67

The Results

Having a comprehensive set of measurements of the network before the upgrade the customer is empowered with the ability to objectively judge the success of any network alteration.

Beethoven Voice Quality Assurance Solution

The Beethoven Voice Service Assurance solution gives you a scalable, configurable set of hardware and software components that fully instrument your network to assure the quality of the voice service. Beethoven offers a customizable suite of voice monitoring and analysis capabilities that enables you to optimally manage and control your network from a customer experience perspective.

You save money by quickly identifying and resolving issues resulting in increased network reliability, and a reduction in the cost of maintaining the high level of service demanded by end customers and regulatory authorities.

Increased revenues result from reduced customer churn through better customer service management, and higher customer satisfaction.

About Calyptech

Calyptech is leading electronic product development company, offering turnkey product solutions and complete outsource design services to a diverse global client base in a range of industry segments including Semiconductors, Networking, Telecommunications, Consumer, Defence and Medical applications. For more details visit www.calyptech.com.