HD VoIP Sounds Better

Brief Introduction

March 2009

Table of Contents

WHITE PAPER

AudioCodes

1. Introduction

For over 100 years, telephones have grown to become a primary means of communications in both our personal and business lives. Even with all the changes from analog to digital, wireline to mobile and eventually to Voice over IP, one thing has remained consistent – limited audio quality. Why do we have to sound like air traffic controllers when spelling out confirmation codes? "Papa, Alpha, Delta". This is due to the limitations that the PSTN enforces on traditional analog and digital telephones and the "3.4 kHz sound barrier". The adoption of VoIP and broadband networks have given us the opportunity to break through this barrier with a whole new range of wideband and high-quality voice coding algorithms that make communications more efficient, effective and natural. HD VoIP allows carriers to differentiate their services with a much improved audio experience, creating customer loyalty and affinity. Enterprises can differentiate themselves with superior voice quality to their customers, building on their quality branding while improving business efficiency. AudioCodes HD VoIP solutions and products - the way sound was meant to be heard.

In traditional PSTN Telephony, all telephony communications were based on the traditional PSTN limited bandwidth (PSTN - 200-3400 Hz and a sample rate of 8 kHz). Voice over Packet networks allow the use of a wider speech bandwidth which offers a higher voice quality than PSTN, creating a wonderful face-to-face live experience. Current wideband coders can use almost twice the PSTN bandwidth.

Pairs of letters such as "P" and "T", "F" and "S" and "M" and "N" sound very similar as their critical energy is carried predominantly in the higher frequencies beyond the PSTN bandwidth. Words like Goal, Bold, Gold have the same sound but contain a very different meaning. By using High Definition Voice, these limitations no longer interfere with the clear comprehension of voice communications.

High Definition increases call intelligibility, enhances the user experience and improves productivity for many speech-oriented applications such as call centers and conferences.

A key article was published by Berkehammar et. al. in the Ericsson Review No. 3, 2006 (http://www.ericsson.com/ericsson/corpinfo/publications/review/2006_03/files/2_amrwb.pdf) describing a consumer trial (150 users) in Germany on a T-Mobile network. This study also demonstrates utilizing the AMR-WB (Adaptive Multi-Rate, wideband) coder vs. using a Narrowband AMR normally used in other mobile networks. The results demonstrated that more than 70% of the users in the trial experienced an improvement in voice quality.

In this white paper, we will discuss HD VoIP technology - and how it can be deployed in the Business and Residential environments. Similarly we will include a number of examples for applications that will benefit from utilizing this technology.

2. Technology Overview

The ITU-T defined the first wideband coder (G.722) in 1988, when several organizations realized the benefit of using wider bandwidth for telephony coding.

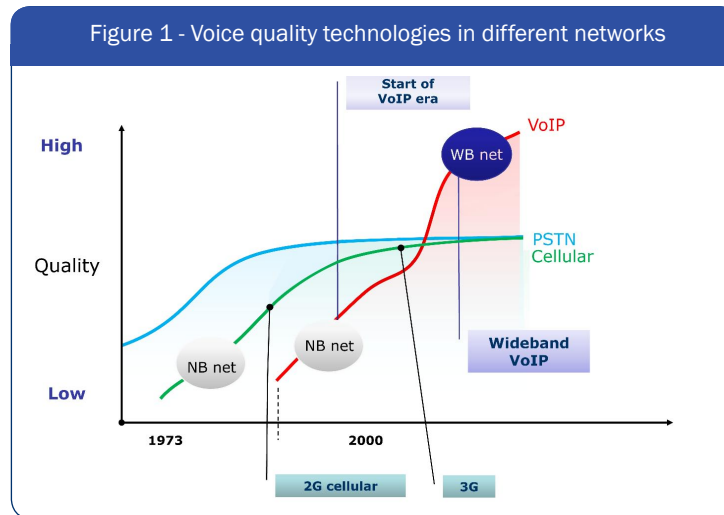Figure 1 - Voice quality technologies in different networks

Figure 1 demonstrates the history of Traditional PSTN and Cellular networks, and the VoIP technology development over the years. The first wideband voice deployments are only just beginning to occur.

The potential of better than PSTN quality originates from using wideband speech processing. While a PSTN network is band-limited to 300-3300 Hz, there is no such limitation for the IP network, as calls between IP Phones or wideband endpoints can utilize wideband speech coders such as AMR-WB, G.722, and others. When utilizing wideband speech at a range of 50-7000 Hz, users can benefit from a more natural sound and increased intelligibility. These factors are very appealing to service providers because they tend to increase the average conversation length.

Figure 2 - Spectrum of a Narrowband and a Wideband speech signal
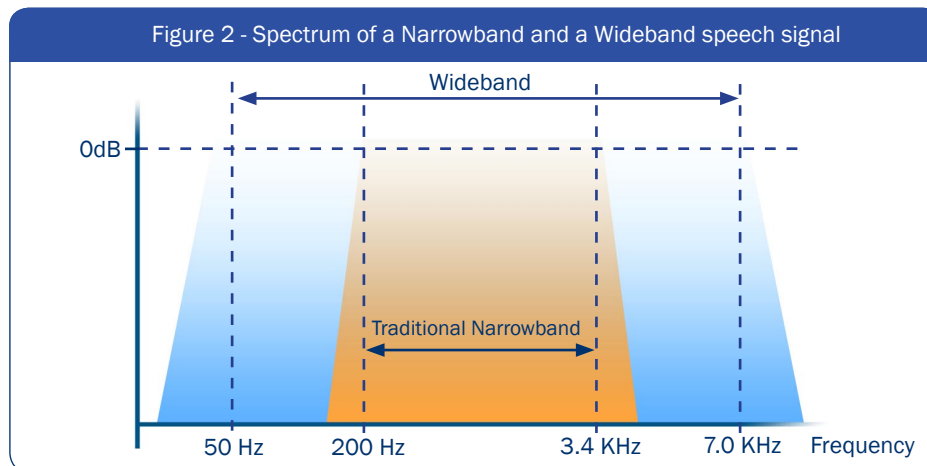
Wideband vocoders operate at a frequency range of 50-7000 Hz (as shown in Figure 2). A common occurrence in many wideband coders is to split this frequency range into 2 bands using a QMF Filter-bank and encoding each band separately. Most of the bits are allocated to the lower band, while the remaining bits are allocated to the higher band.

As can be seen in Figure 3, uncompressed wideband speech (Direct WB, 4.5 MOS) provides a significant quality edge over narrowband speech (Direct NB, 3.5 MOS), more than a full MOS point. Similarly, such an advantage is delivered by wideband voice codecs when compared to the traditional narrowband VoIP codecs. When comparing a modern wideband coder, such as G.729.1 at 24 or 32 kbps to a traditional narrowband VoIP coder such as G.729A at 8 kbps, the improvement is even greater and can be extended to almost 1.5 MOS at a relatively minor increase in bitrate, when employed over broadband IP networks.

Figure 3 - Test results of Wideband and Narrowband speech quality from two independent labs (taken from ITU G.729.1 test results)
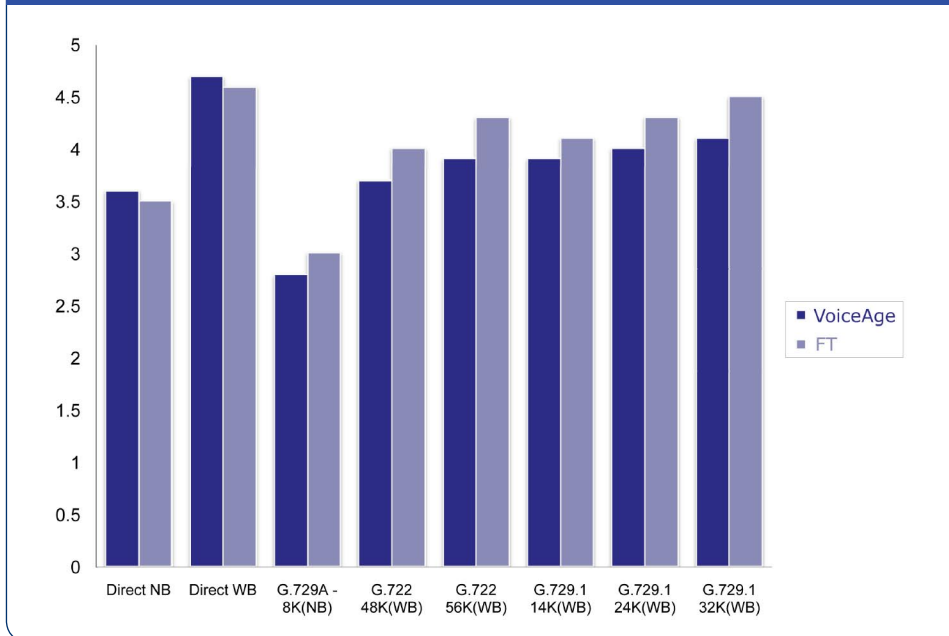
3. Business Environment

HD VoIP is expected to become a major factor in the improvement of business efficiency in the current global business environment. Today's business globalization of outsourcing tasks such as Call Centers, R&D and Helpdesk to foreign countries requires an improvement of voice fidelity. This is extremely important as the pronunciation and grammar is very different between foreign employees. The "p" and "t" can usually be changed causing words like "paint" to become "faint", or "copy" which becomes "coffee". This is even more important with conferencing applications. Many people using conference bridges are familiar with problems associated with bad voice quality. The efficiency of a conference call can be greatly reduced even if only one participant experiences voice quality problems. A call can be paused in the middle to ensure that all persons on the call have comprehended the speech content, as it is possible that two people could have misunderstood one another.

HD VoIP can bring about a large improvement to business productivity. Travel has become a major business expense item due to the current rise in fuel costs. By reducing travel, businesses can accomplish large cost savings. HD VoIP technology can bring people closer, enable fluency of conversations and create productivity.

In order to benefit from the sound quality which HD VoIP technology allows, the endpoints must support the technology itself. Currently, regular POTS phones are limited by the handset, microphone and speaker blocking the extra bandwidth which HD VoIP technology transmits. Wideband IP Phones solve this problem by supporting wideband coders (i.e. G.722 or Microsoft RTA), the high quality speaker and microphone. As more and more business environments are migrating towards a full VoIP environment, POTS phones are less common and the deployment of HD VoIP is easier.

We expect that as more employees adopt the high quality sound of HD VoIP technology, a large demand will be created, encouraging service providers to offer this option to consumers.

4. Wideband Applications for Diverse Industries

High Definition VoIP technology enhances applications deployed in many industries, and can save lives in critical environments.

Industries such as banks and trading rooms (receiving orders via telephone), travel agents (handling travel arrangements and reservations), military and Home Land Security (issuing military orders), Air Traffic Control (in which voice is a vital component) - all need intelligibility improvements that can be achieved with this technology.

HD Audio Conferencing can improve productivity and reduce costs (in business environments), and enable medical professionals to give more accurate treatment (in the case of Telemedicine). HD Audio Conferencing enables the idea that speakers are present in a room as if they were actually there.

In the case of Speech Recognition applications, ASR engines need as much information (or bandwidth) as possible in order to improve the recognition of the spoken voice. Low audio quality is one of the reasons for the slow adaption of these types of applications. HD VoIP significantly improves the quality and usability of Speech Recognition applications.

People originating from different geographic locations that communicate by using different native languages and accents can significantly improve the clarity of their call by using Wideband coders. In the mobile environment, where there is interference of background noise, HD VoIP can help enhance the user experience by improving the voice quality and differentiate between various carriers. Internet applications like gaming, chat or streaming can benefit from the new HD VoIP experience. HD VoIP can also be used for radio broadcasting, news or TV broadcasting.

Lastly, globalization is occurring rapidly with additional call centers located in non-native geographies, having to effectively communicate and work with different users in order to resolve problems.

5. AudioCodes HD VoIP Offering

AudioCodes HD VoIP delivers innovative, reliable technology providing customers and partners with a comprehensive selection of cost-effective and flexible network devices, end-user appliances and voice processing technologies.

AudioCodes HD VoIP offers a broad range of feature-rich and scalable products supporting HD VoIP quality utilizing the most popular wideband coders such as G.722, G.722.2, G.729.1, G.711.1 and Microsoft RTA.

Enhanced Algorithms and Services that enrich the HD VoIP experience:
• Packet Loss Concealment
• Acoustic Echo Cancelations
• Adaptive Jitter Buffers
• Wideband Voice Conferencing
• Wideband Media Transcoding

AudioCodes' portfolio of products can be seamlessly integrated with many Application Server Providers, offering a complete solution for a variety of High Definition applications in many important segments, i.e. Banks and Trading Rooms, Travel Agencies, Government, Health and Telemedicine, Air Traffic Control, Public Safety, Education and the Army. All require top quality voice technology such as media adaptation, encoding, decoding and the mixing of wideband voice.

For more details about AudioCodes offering, please visit: *www.audiocodes.com/hdvoip*

ABOUT AUDIOCODES

AudioCodes Ltd. (NasdaqGS: AUDC) provides innovative, reliable and cost-effective Voice over IP (VoIP) technology, Voice Network Products, and Value Added Applications to Service Providers, Enterprises, OEMs, Network Equipment Providers and System Integrators worldwide. AudioCodes provides a diverse range of flexible, comprehensive media gateway, and media processing enabling technologies based on VoIPerfect™ – AudioCodes' underlying, best-of-breed, core media architecture. The company is a market leader in VoIP equipment, focused on VoIP Media Gateway, Media Server, Session Border Controllers (SBC), Security Gateways and Value Added Application network products. AudioCodes has deployed tens of millions of media gateway and media server channels globally over the past ten years and is a key player in the emerging best-of-breed, IMS based, VoIP market. The Company is a VoIP technology leader focused on quality and interoperability, with a proven track record in product and network interoperability with industry leaders in the Service Provider and Enterprise space. AudioCodes Voice Network Products feature media gateway and media server platforms for packet-based applications in the converged, wireline, wireless, broadband access, cable, enhanced voice services, video, and Enterprise IP Telephony markets. AudioCodes' headquarters and R&D are located in Israel with an additional R&D facility in the U.S. Other AudioCodes' offices are located in Europe, India, the Far East, and Latin America.

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