

More and more players in the fast-evolving and highly competitive world of consumer electronics are seeing the advantages of adding fun and useful convenience features like speech and audio to differentiate their products from the pack. As speech and audio capabilities become integrated into every type of consumer product, from toys and interactive games to PDAs and home security systems, interacting with these everyday electronic products is becoming easier and more intuitive through natural language conversational interfaces.

A key enabler of this dramatic enhancement in human-device interaction is provided by speech and audio coding/ decoding (codec) technology. Codecs provide essential functions for digital speech and music recording and reproduction, and they can provide advanced features that truly move you ahead of your competitors. But every application has unique requirements and challenges, so working with experts is important for making the right choices in balancing five key codec attributes:

- Audio quality
- Compression rate
- Delay
- Interoperability
- Complexity

Optimizing these qualities usually involves trading off their relative performance due to interdependencies. So, in most cases, you need to focus on optimizing one or several attributes based on your application's main requirements. With our vast experience in codec technology development and speech and audio processing, VoiceAge welcomes the opportunity to work with you on your innovative products to help you deliver best-in-class speech and audio to delight your customers.

*Note that the pie charts represent the relative importance of the five attributes for each particular case.*

## Low Complexity, High Compression, Added-Value Features



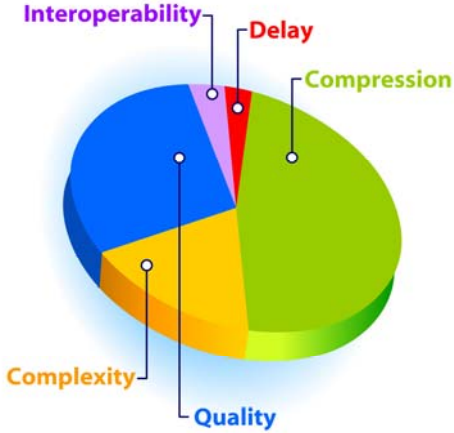
A leading consumer product manufacturer needed to store and replay speech and audio in a series of interactive products. Processor power was their main constraint because the processor had to be reasonably priced to allow the product to fit into a competitive and affordable price range. VoiceAge developed a **custom low-complexity implementation** of a variable bit rate codec that could run on an inexpensive processor while providing excellent quality audio and a high compression rate. The low complexity of this codec also ensured that the processor consumed less power, prolonging battery life.

High compression enables products to store more audio – a saving that is repeated each time additional content is purchased on external media: each unit of external media benefits from the additional play time.

The extra storage benefit provided by our low bit rate codecs can be multiplied using **concatenation**: instead of storing complete recordings for each possible alternative, words and phrases are stored in the database and then concatenated using logic that greatly increases the number of possible phrases to play.

**VoiceAge Added-Value Features:** VoiceAge technology supports greater reuse of the same words and phrases by generating playback variations (e.g., different speakers) through **special effects**.

## For Streaming: Quality & High Compression



A streaming audio provider wanted to deliver reliable, rich sound to a maximum number of both dial-up and broadband customers. VoiceAge recommended a low bit rate codec to provide great reliability for dial-up customers looking for uninterrupted Internet radio.

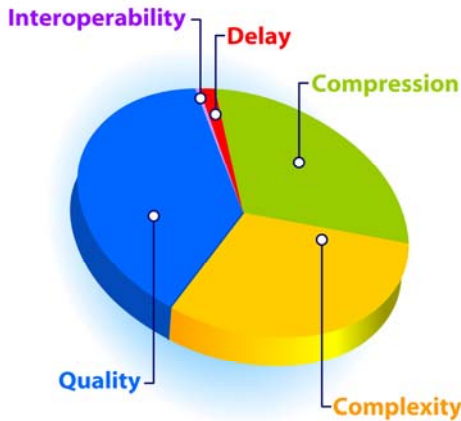
When higher bit rates are used for streaming audio over dial-up connections, network congestion is likely to force interruption of the streaming while the application buffers the audio. A low bit rate, high-quality codec is less likely to have interruptions of this type.

A low bit rate codec can be supported by even mid- and low-end playback devices, and it also allows the content provider to serve more customers over a given amount of available bandwidth.

**VoiceAge Added-Value Features:** VoiceAge offers multiple strategies for increasing robustness, including, for example, **interleaving**. These techniques are built right into the codecs and can be optimized based on the system and the codec.

# Adding Speech or Audio to Consumer Electronics

## For Audio Books: Quality, High Compression, Low Complexity



An audio book provider delivers audio programming over the Internet, including complete and abridged books, newspaper and magazine programs and radio programs. Customers download programs to their PCs and then listen to them on the PC or upload them to a mobile audio player and listen to them on the go. They can also stream programs and listen directly.

For this provider, delivering **excellent audio quality** was most important when selecting a codec. In addition, to accommodate a wide range of user profiles and playback devices, they offer most programs at multiple bit rates, enabling their customers to choose the option that suits them best.

Low complexity was also an important consideration because it enabled support of a wide range of playback devices, including popular low-end ones.

**VoiceAge Added-Value Features:** VoiceAge technology supports **easy navigation** and **bookmarking** – so listeners can quickly find their place again even after they've turned their playback device off and on again! Fast and slow playback features give customers even more control.

The following table demonstrates the importance of a high compression rate both for manageable download times and for the ability to store an audio program that lasts several – or many – hours.

Download Times and Storage Needed for the bestselling novel The Da Vinci Code (Playtime 16 h, 43 min.)

Codec	Download time		Storage needed (Mbytes)
	Dialup modem (56 kbps)	High speed (1.5 Mbps)*	
ACELP®.net @ 5 kbps	1 h, 30 min.	3 min., 21 s	35.9
ACELP®.net @ 6.5 kbps	1 h, 56 min.	4 min., 21 s	46.6
ACELP®.net @ 8.5 kbps	2 h, 32 min.	5 min., 41 s	61
ACELP®.net @ 16 kbps	4 h, 47 min.	10 min., 42 s	114.8
G.729 (8 kbps)	2 h, 23 min.	5 min., 21 s	57.4
MP3 @ 64 kbps	19 h, 6 min.	42 min., 48 s	459.1
MP3 @ 128 kbps	38 h, 12 min.	1 h, 26 min.	918.3

\* With DSL ranging from 512 kbps to 1.5 Mbps and cable modems giving 1.5 Mbps, we are using 1.5 Mbps.

## About VoiceAge

VoiceAge Corporation is the forerunner in the development and dissemination of speech and audio compression technologies and solutions at the convergence of wireless, 2.5G, 3G, Wi-Fi and Internet protocols. Our active participation in the development of 15 international telecommunication standards and our extensive experience as developers of codec implementations for diverse platforms and environments have nurtured world-class expertise that we apply to each new project. The VoiceAge product portfolio includes both off-the-shelf implementations and custom codec solutions.

VoiceAge is defining the state of the art in low bit rate, high quality speech and audio coding technologies. Our research and development teams have implemented numerous custom designs, for example, low-complexity codecs, Windows RTC adaptor, RTP monitoring, and conference talker-selector. Our codecs offer a wide range of bit rates as well as value-added features including variable playback, pitch shifting, noise reduction and – soon – morphing.

VoiceAge will work with you to respond to your specific requirements for quality, performance, and complexity. Whatever your needs in speech and audio coding solutions, whatever constraints your product has, VoiceAge expertise in development and implementations will help you deliver quality, efficiency and dependability at a competitive price.

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