Speakers-on-a-Chip: The Convergence Solution for Audio Entertainment and Voice Communication Peripherals

White Paper

The PC is at the center of the convergence of audio entertainment and voice communication in homes and offices today. In addition to using PCs for surfing the Internet and as productivity tools, a growing number of people are using their PCs for entertainment and communication. Some examples include:

- Instant messaging (IM) connects people across the globe and is driving a social networking phenomenon.
- Apple's popular iPod player requires storing thousands of songs in the PC. The 140 million iPod owners are more likely to listen to music while working from their PC.
- In universities, students can taking remote classes and participate in class discussions real-time via Web seminars (Webinars).
- A major broadcast network found new ad-generating opportunity in streaming prime-time shows over the Internet. As Disney president and CEO Bob Iger said in March 2008: "In the years ahead, broadband on the computer will be the primary source of entertainment for kids. It's just as important to them as the TV set now."
- Companies such as Apple and Netflix offer full-length movies online.
- Online retailers offer visitors the option of clicking a button to have a sales associate call them immediately, thereby seizing an impulse-buying opportunity.
- Cisco, Microsoft, and Polycom are working on Unified Communication solutions to help businesses collaborate and communicate virtually.

The common denominator for all of these exciting applications is that they each can benefit from a new class of audio peripherals that delivers high quality and intuitive experience to the end user.

To maximize the user experience for each audio application, consumers usually have desks full of audio peripherals for their PCs. Depending on the task, the user needs to change the audio setting in software and physically switch between different peripherals. For example, a pair of external PC speakers or an LCD monitor sound-bar is a good option for listening to music, but to make or pick up an IM voice call, the user often must switch to headphones and a microphone.

People who extensively use the IM voice feature would actually prefer the untethered alternative of a hands-free speakerphone. Although different peripherals offer unique benefits for specific tasks, the abundance of choices creates huge confusion for consumers and a cluttered desktop of seldom-used devices. Consumers can really benefit from a new class of digital, all-in-one sound systems that combine the functionality of PC speakers, the convenience of a hands-free speakerphone, and the connectivity to other portable media players or smartphones. Just as important, it can save the user from learning how to operate individual features by providing an easy and intuitive user interface.

Desirable Integrated Experiences in Different Scenarios

Deliver Immersive Music and Video Experience

- When it comes to choosing PC speakers for music and/or video applications, consumers are concerned about loudness, desk space, and the number of channels. Most users ultimately choose the compact 2/2.1 channel speakers due to space constraints, with the unfortunate trade-off of lower volume and flat soundstage. The latest advances in audio Digital Signal Processing (DSP) could potentially improve the experience by dynamically controlling the volume and frequency responses, as well as by manipulating the phase to create the psycho acoustic perception of expanded 3D soundstage.

Better Voice for Social Networking

- Echo remains one of the most challenging problems for PC VoIP applications. To reduce this speaker-to-microphone feedback problem, some IM networks try to suppress echo from the system. This method is often unreliable due to system or network latency. Some IM applications simply recommend that users wear headphones or a headset for better quality. To make the situation even worse, most people have multiple IM applications installed on their PCs in order to keep in touch with friends and relatives on different IM networks. The lack of Acoustic Echo Cancellation (AEC) or the varying echo reduction performance among the different IM networks creates a poor experience for end users and is a key issue prohibiting mass adaption of PC-based VoIP. It is critical for the audio peripheral to support hardware AEC that is independent of the IM networks and the OS. Additional features to reduce background noise and block out interference speech are also welcomed by IM users.

Enables Greater Interactivity for Gaming

- One example is multi-player gaming, where participants want the ability to converse with other players. Today, that requires buying a headset. And in order for the voice to come through clearly without being impacted by the background audio effects, players remove their hands from the controllers to hit the one-way talk button. What gamers desire is a two-way, hands-free speakerphone that works well with background audio effects, all without removing their hands from the controller.

Enhances Distant Learning

- Distance learning is increasingly common worldwide, particularly at the higher education level. In the United States, for example, more than 96 percent of the largest colleges and universities offer online courses, according to the Sloan Consortium. This trend will grow as schools at every level look for more ways to accommodate students' lifestyles, safety, and learning preferences rather than the other way around. The Webinar tools used today are primarily one-way video streaming. The student still needs to call in to the studio or text message the instructor in order to ask question. The instructor has limited ability to observe a student's engagement and has no way of promoting in-class discussion. A low-cost Unified Communication peripheral that supports two-way video conferencing features will greatly enhance the quality of the distance education experience.

Improving Telecommuting Effectiveness

- In the United States, 26.1 million Americans worked from home at least one day a month, and 22.2 million at least once a week, according to a 2005 survey by The Dieringer Research Group. Some companies have set up the telecommuting workforce with VPN softphones, which let managers contact remote employees by simply dialing their PBX extensions. However, without the proper audio peripherals, the quality of the call can be very poor. Some of the reasons for poor quality calls can be echo, tinny voice, weak voice volume, and disturbing background noise. These problems can be solved with an audio peripheral that supports high-definition voice-grade echo cancellation and noise reduction technologies. Additional features such as the ability to switch between 360 degrees (conference room conversation) and 40 degrees (private conversation) microphone pick-up ranges add flexibility to the telecommuter's office and work style.

Challenges in Multi-function Audio Peripherals

Vendors that want to develop a digital, all-in-one PC sound system are generally concerned with two major issues: cost and reference design support.

Cost

To hit the sweet spot of market price, audio designers have a tight cost budget to work with when it comes to choosing the appropriate codec, controller, headphone and speaker amplifiers, audio/voice processors, and companion software.

Reference Design Support

Developing a convergent audio solution requires domain expertise in both audio and voice. Although designers can try to combine a speaker reference design and a speakerphone reference design from different chip (technology) vendors to create a new multi-chip custom design, it will be difficult to get support from a single contact in order to optimize both audio and voice performance.

Conexant's CX20562 is an innovative speakers-on-a-chip solution that combines the functionalities of the digital audio/voice processor, audio codec and Class-D amplifier, in one cost-effective, 48-pin Quad Flat-No Lead (QFN) package. This solution is optimized with stereo, high-fidelity 24-bit DAC for music rendering. It also features a built-in echo-free speakerphone with wideband AEC and noise reduction hardware DSP. The high-quality music speaker and voice speakerphone combination is made possible with the latest advances in all-CMOS mixed-signal and DSP integration. This turnkey solution eliminates the need for a multiple-chip reference design, and makes it easy and cost-effective for audio designers to design convergence products for high definition audio and voice applications.

The CX20562 supports many marketing value-added features such as music on-hold, Aux fade-in/ fade-out, BrightSound™, DSP Array Microphones, Global System for Mobile communications (GSM) noise immunity, and the Instant Messaging Launch button. The CX20562 has one plug-and-play USB interface for PC connection and one auxiliary analog input for connection with other audio peripherals. The device supports both digital and analog volume control, microphone mute, and speaker mute. The CX20562 features an additional interface to a 20-key programmable keypad and an LCD display interface. The built-in Class-D amplifier is capable of driving a 1.2 W on 4 Ω load via USB host power. The efficiency of the Class-D amplifier makes it ideal for portable audio applications.

For higher output applications, an external amplifier can be connected to CX20562 via headphone/line level output.

Conexant's speakers-on-a-chip solution provides the technology platform to make the convergence of audio entertainment and voice communication a reality.

Conexant's comprehensive portfolio of innovative semiconductor solutions includes products for Internet connectivity, digital imaging, and media processing applications. Conexant is a fabless semiconductor company that is headquartered in Newport Beach, Calif. To learn more, please visit www.conexant.com