AES 18th International Conference Program

Audio for Information Appliances—Challenges, Solutions, and Opportunities

2001 March 16–18
Burlingame, California, USA

Technical Sessions

Friday, March 16 **9:30 am–11:00 am**

SESSION 1: OPPORTUNITIES

1-1 Information Appliances—New Toys and New Business Models—*Greg Bartlett,* Digital Harmony Technologies, Inc., Seattle, WA, USA

Wristwatches with built-in MP3 players, cell phones with MP3 players, ballpoint pens with MP3 players, audio/video receivers with MP3 players, free hardware, data subscriptions, digital plumbers, personal media assistants—the world is exploding with new digital toys and business models. Audio and information technologies have collided and spawned incredible opportunities, challenges, and solutions for technologists and businesses.

1-2 The Future of Media—Interactivity and Choice— *John Bregar,* Loudeye Technologies, Seattle, WA, USA

With third-generation wireless devices only a year out and the Internet set to create over a trillion dollars in e-commerce in 2001, the opportunities for rich media on the net are boundless. Wireless and personal handheld devices demand new and more creative Web media experiences. Encoding systems that can easily morph and deliver new codecs or audio enhancements on short notice are presented. Specifically, we believe that audio on the Web is moving in three directions: traditional digital music download/distribution, music lockers and radio stations, and wireless streaming applications and devices. The paper examines the technical barriers and obstacles to achieving success within these different business models including storage issues, file sizes and bit rates, file-naming conventions, quality control for mass audio production, and postproduction for mass audio processing.

1-3 Technology Issues for the Next Generation of Music Services—*Phil R. Wiser,* Liquid Audio, Redwood City, CA, USA

The mass acceptance of Internet audio by consumers has validated the future of nonphysical music delivery. The next generation of music services must improve ease of use and quality in order to create a viable business. Most importantly, these services must include fees for the consumer. This paper explores the potential features of these future music services. It also examines the technical requirements for information appliances to provide music discovery, music organization, export to alternative devices, and subscription billing.

1:00 pm–4:00 pm

SESSION 2: AUDIO CHALLENGES

2-1 Reorganizing Audio Video Functions—*Anthony Grimani,* PMI Ltd., Fairfax, CA, USA

Consumer audio and video products have evolved over the years to meet user needs for functions and forms in a non-networked environment. Once connected in system, these products reveal a high degree of redundancy, wasted functionality, and suboptimal quality. Active networking of these products will allow us to streamline equipment components and restructure component costs for higher performance and simpler user interface. This paper presents a survey of functions and performance quality expected by the consumer and discusses options for organizing these in a high performance, all-digital networked environment using protocols such as IEEE 1394.

2-2 Audio Quality: Performance Testing of Information Appliances—*Marshall Buck,* Psychotechnology, Inc., Los Angeles, CA, USA

Traditional audio recording and playback hardware has recently been replaced or augmented by PC-based, laptop, and handheld devices. In some cases these information appliances (IAs) have attempted to match the quality standards of traditional audio equipment. In other cases the applications have been new and innovative, focusing on low cost and portability, using wireless, packet-switched, networked, and lossy compression methods. Traditional audio test techniques are still useful to characterize the new equipment. Some current and proposed practices are presented, which allow rapid and accurate testing of IAs, including analog and digital electronics, and acoustic transducers. A review of the factors that are important to audio quality is given.

2-3 Audio in a 1.5-Volt World—*Dennis Bohn,* Rane Corporation, Mukilteo, WA, USA

Information appliances (IAs) put severe restrictions on audio circuits. What audio quality is possible? Which audio parameters are compromised in low-voltage designs? What can you do about it? Design parameters are examined, and guidelines are suggested. Important criteria are dynamic range, noise, interconnecting impedance, connector compatibility, and grounding. The paper includes a performance summary of a sampling of IA audio devices.

2-4 Optimizing Audio Quality for Internet Streaming and Distribution—*Robert Clearmountain* and *Richard G. Elen,* Apogee Electronics Corporation, Santa Monica, CA, USA

Depending on the bandwidth available and the type of application (from live streaming to music distribution), the quality of the Internet audio experience varies dramatically; and different techniques can and should be used to ensure the best audio experience for the listener. The paper discusses these techniques with examples, including a selection of common data rates and encoding schemes.

2-5 Why We Still Need Perceptual Codecs—*Karlheinz Brandenburg,* Fraunhofer IIS-A AEMT, Ilmenau, Germany; and Ilmenau Technical University, Ilmenau, Germany

Perceptual coding is one of the enabling technologies for a whole generation of new services and products, including Internet audio. It saves an order of magnitude in bandwidth or storage cost for high-quality audio and enables audio to push through lower bandwidth if lower quality is acceptable. The availability of more bandwidth to the consumer raises the question of the necessity of perceptual coding in future systems. The paper presents an overview of the basic techniques used for perceptual coding and discusses the state of the art. Better audio quality and new features for audio compression will prolong the lifetime of this technology.

6:00 pm–7:30 pm

KEYNOTE ADDRESS AND RECEPTION

Rocket Network—The Global Production Network—*Willy Henshall,* Rocket Network, San Francisco, CA, USA

See a live collaborative audio postproduction film session, with seamless networking between different audio applications, and use Rocket Network's online storage, archiving services, and global talent pool. Rocket powered products by Digidesign/Avid, DSP Media, Emagic, Euphonix, MOTU, Steinberg, and Waveframe allow audio professionals to access their creative projects and work with anyone, from anywhere, at anytime.

A reception will follow.

Saturday, March 17 **9:00 am–10:30 am**

SESSION 3: SOFTWARE CHALLENGES

3-1 Digital Audio Receivers (DARs) Extending Internet Music on Home Networks: A Design Review—*Tarek Elabbady,* Microsoft Corporation, Redmond, WA, USA

Phenomenal adoption of Napster, downloading music and listening to Internet radio, has brought half of the U.S. Web population into the digital media world. In addition to the growth in streaming activities, such as Internet radio, offline playing of content is very popular, more specifically playing back downloaded files. Digital media continues to expand the role of the PC at home, moving it into the entertainment space. The PC provides a near-term playback platform that accommodates a variety of media types. Over time the PC will evolve as a point-of-purchase media and storage hub, which will connect consumers to an online distributor and enable them to off-load digital assets to dedicated devices for quality playback. The emerging new generation of digital audio players (DARs) use data home networks technology to extend digital media away from the PC. This paper proposes a design for the DAR as a node on data home network for playing back protected and unprotected digital music from a server PC. It also explains how this design makes it possible for the DAR to be remotely discovered and controlled and to stream, transcode, and decompress protect digital music from its PC store.

3-2 Home Audio Video Interoperability (HAVI)—*Jean Moonen,* Philips Silicon Valley Center, Sunnyvale, CA, USA

The Home Audio Video Interoperability (HAVI) specification provides a home networking standard for seamless interoperability between digital audio and video

consumer devices, allowing functions on one appliance to be controlled from another appliance regardless of network configuration and appliance manufacturer. HAVI supports a scalable device architecture, which allows small and low-cost devices, or devices without display capabilities, to export a fancy user interface to display capable devices, such as TV sets.

3-3 In Search of a Mapping from Parameter Space to Perceptual Space—*Chris Bruce Weare* and *Theodore Calhoun Tanner, Jr.,* Microsoft Corporation, Redmond, WA, USA

This paper discusses a methodology for efficient and concise implementation of content based searching (CBS) and content-based discovery (CBD) of audio and music. The method proposed maps a predefined parameter space to a psychoacoustic perceptual space. This mapping will be used to describe a system, which will allow content-based discovery of music that enables similar orchestrations to be readily accessed and compared in a single-ended fashion. The paper compares and contrasts it to other current means of recommendation music engines, such as collaborative filtering (CF) techniques, as well as other proposed content-based retrieval systems. Results based on a very large corpus of music are presented. The paper also discusses future areas of research and identifies other avenues of audio applications where this work may be utilized.

1:00 pm–4:30 pm

SESSION 4: INTERFACING SOLUTIONS

4-1 The Audio-Visual Object Standard MPEG-4—*Rob Koenen,* InterTrust Technologies International, London, UK

This paper explains the basics of the MPEG-4 Standard, which defines a novel way to represent audio-visual information as a collection of objects and explains how they are structured in time and space. The MPEG-4 Standard has different types of objects, representing still images, video of rectangular or arbitrary shape, speech, and audio. The signal types can be either recorded or synthesized. Different objects have their own optimal coder. There are possibilities for local and remote interaction with the scene, including mechanisms for spatial auralization. MPEG-4 also includes the unique “structured audio,” which encompasses MIDI. The paper highlights how these tools can be used in appliances.

4-2 IEEE 1394 for Information Appliances—*Bob Moses,* Digital Harmony Technologies, Inc., Seattle, WA, USA

IEEE 1394 has been hailed by industry groups as the future ubiquitous interconnect for a broad range of digital media devices, ranging from information appliances to personal computer peripherals. Protocols have been defined for carrying virtually every format of audio and video as well as Internet Protocol, files, and various control protocols. This paper presents information about IEEE 1394 protocols and hardware implementations relevant to developers of information appliances.

4-3 Bluetooth—*Mike Foley,* Microsoft Corporation, Redmond, WA, USA

Bluetooth wireless technology is being positioned by some as the be-all, end-all wireless technology. The initial applications of the technology focus on wire replacement scenarios. New protocols are being developed for delivering audio and video content over the wireless connection. This paper presents an overview of the relevant portions of the currently defined Bluetooth protocols, their strengths and weaknesses for AV solutions, as well as the direction the technology is being investigated to address its weaknesses.

4-4 Discoverable Audio Topology—Plug and Play and USB Audio—*Billy Brackenridge,* Microsoft Corporation, Redmond, WA, USA

The USB Audio Device Class allows an audio device to identify itself so that its features can be exploited by whatever device it is plugged into. For example, an USB audio device can be a pair of stereo loudspeakers, a telephone, a mixing console or a 5.1-channel loudspeaker system. The controlling device recognizes the USB audio device and controls it. Discoverable Audio Topology consists of enumerating a USB audio device as a set of output terminal nodes. Each output terminal node is the root of a tree whose branches terminate in input terminal nodes. The controlling device can dynamically build a control structure for any arbitrary USB audio device by walking this set of trees and enumerating the control property sets associated with each node of the tree. This paper gives some examples of USB audio devices and shows how a control strategy for these devices can be dynamically discovered by a host controller.

4-5 Quality of Service (QoS) for Streaming Audio over Wireless LANs—*Jason Flaks,* Dolby Laboratories, Inc., San Francisco, CA, USA

Streaming audio in computer networks requires a level of quality of service above and beyond the best-effort service that is typically provided. The need for enhanced quality of service (QoS) is even greater in wireless networks where issues of interference, security, roaming, and bandwidth constraints are added. This paper discusses the QoS issues that are important for providing high-quality streaming audio over wireless networks. In addition, an overview of future QoS enhancements in IEEE 802.11 and HomeRF is provided.

4-6 Optimization of MPEG-2/MPEG-4 AAC for Error-Prone Transmission Channels—*Bernhard Grill* and *Ralph Sperschneider,* FhG IIS, Erlangen, Germany; and *Sanae Hotani,* NTT DoCoMo, Inc., Yokosuka, Kanagawa, Japan

MPEG Advanced Audio Coding (AAC) is the newest of the successful MPEG perceptual audio coding standards. While the basic algorithm was standardized as an extension to MPEG-2 in 1997, AAC has recently been substantially enhanced in MPEG-4. New features include additional coding tools for improved efficiency at very low-bit rates, bit-rate scalability extensions, and tools that significantly enhance the performance over error-prone transmission channels. The paper reports primarily on the work conducted to optimize AAC for environments with high error rates.

6:00 pm–6:30 pm

KEYNOTE ADDRESS

The Wireless Revolution: Signal Processing as the "Great Enabler"—*H. Vincent Poor,* Princeton University, Princeton, NJ, USA

During the nineteenth and twentieth centuries, communications underwent revolutionary changes: first the telegraph and then the telephone emerged and transformed into wireless transmission. Now at the advent of the twenty-first century, an even more revolutionary transition is taking place as the Internet moves into the wireless domain. Like its predecessors, today's wireless revolution is being made possible by major strides in electrotechnology. In particular, the current drive to push system capacity, quality of service, and mobility well beyond their preconceived limits, enabling striking innovations in signal processing methods and technology. These innovations include direct developments, such as multimedia compression, multiuser detection, space–time processing and coding, and turbo decoding; as well as indirect developments, such as the use of signal processing techniques to push practical microlithography beyond its current limits. This paper provides an overview of some of these developments in the context of their impact on emerging and future wireless communications applications, such as third-generation cellular telephony, broadband local access, mobile computing, etc.

Sunday, March 18 **9:00 am–11:30 am**

SESSION 5: CASE STUDIES

5-1 **Sonic Box Internet Radio,** *David Frerichs,* Sonic Box

This paper discusses Sonic Box Internet Radio.

5-2 **The Dharma Platform—***Mark Philips,* iObjects, Bellevue, WA, USA

Music collections tend toward chaos. CDs get scratched, lost, stolen, broken, and are not an ideal way to organize or access a music collection. New electronics should enhance your life, not fill it with clutter. IObjects builds interactive stereo components. Dharma can organize more than your music collection. It can transform the way music interacts with you.

5-3 **Audio Hardware and Software on Xbox—***Brian Schmidt,* Microsoft Corporation, Redmond, WA, USA

A modern video game audio system needs to be designed to generate high-quality, real-time interactive audio suitable for delivery on modern audio systems. This paper discusses the audio hardware and software in Microsoft's Xbox video game console system. First, the issues and problems of interactive audio are covered. Then, how the Xbox hardware and software address these issues are discussed.

5-4 **Internet Appliance Audio in Practice—***Jon Watte,* Be Incorporated, Menlo Park, CA, USA

This paper outlines some of the issues associated with implementing audio functionality on current and near-future connected appliances. A case study is made of the BeIA Internet appliance operating system. Topics include hardware/software balance, systems programming challenges, and user experience.

5-5 **3Com Radio—***Jim Reeks,* 3Com/Kerbango

This paper describes 3Com Radio.

1:00 pm–2:00 pm

PANEL DISCUSSION

Moderator: **Ted Tanner, Jr.,** Microsoft Corporation, Redmond, WA, USA

A panel of experts will discuss the following topics:
- Proliferation of standards and platforms
- High cost and limited supply of bandwidth, memory, CPU power, etc.
- Will networks provide sufficient quality of service for high-quality audio?
- Sound quality: Is it important? Is it possible?
- How will the audio business change?
- Will the audio design engineer of the future know what dB means?