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AVB – A New Protocol for Multi-Channel Multimedia

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Abstract

AVB (Audio/Video/Bridging) is a new open standard for distributing real-time multimedia signals over standard Ethernet infrastructure. Its goal is to replace ad-hoc computer interfaces with an easy to use, well-written, open, industry standard. We will demo a multi-channel sound installation running using Meyer speakers running AVB.

Keywords

Audio, Video, Multimedia, Open-Source, Protocol, Installation, Mult-Channel, Demo

Introduction

Currently it is very challenging for a sound artist to create multi-channel works using a computer. It is even more challenging to create multimedia art works that are "transferable", i.e. a technically challenging work that a physically distant museum could set up with without the artists' direct involvement. The goal of Audio/Video/Bridging (AVB) is to solve these problems with a well-written, open, industry standard. The standards body behind AVB is The Institute of Electrical and Electronics Engineers (IEEE), the same industry trade group responsible for the 802.11x wireless Ethernet standards. These thoughtful standards, with broad industry support, have revolutionized computing. It is possible to take a Mac, iOS, Linux, Android, or Windows device into any coffee shop and connect to a wireless Ethernet network. No proprietary drivers, special interfaces or dongles are needed. AVB should do the same for multimedia.

The Problem

Intermedia artist often struggle with technology to create multi-channel audio and video works using a computer. It is even more challenging to create works that are easy to install without the artist's physical presence. For example, if a sound artist has an interactive 8 channel audio composition, the setup might look something like this: A Mac Mini computer connected by USB to an interface (from a company such as MOTU, Focusrite, etc) would run audio software such as Pure Data (PD) which creates the audio and then send it to the interface. This interface might have 12 analog input channels, 4 output channels, and MIDI I/0. The unit requires custom drivers from the manufacture to operate on the Mac Mini. For simplicity lets assume the whole piece is performed using the open source (and free) software package PD. And for the sake of the artist, let us assume the first performance goes well, is documented satisfactorily and garners interest from another venue.

How would the sound artist "sell" or loan this piece to a museum in another state? Even if the museum has a Mac Mini, most likely they have a different audio interface; for example, instead of a MOTU USB audio interface they own a Firewire Focusrite interface. While these two units are functionally equivalent (they both have 12 analog inputs, at least for analog outputs, MIDI I/O) each require a proprietary driver, and each maps inputs and outputs differently, and their interface to PD is different as well. So unless the museum in question has an interactive audio expert, there is very little chance that a suitable setup could be configured to perform the audio piece. Currently the only solution is to ship all the hardware (the artist's own computer, interface, loudspeakers, microphones, cables, etc) to the gallery, but even then the setup is arduous. Now, imagine that in addition to multichannel audio, the artist also has multi-channel video and the problem expands exponentially.

The Solution

AVB seeks to standardize real-time multimedia content creation, distribution, and performance around ubiquitous CAT5e Ethernet infrastructure. It utilizes well-established technologies as well as real-time clocking protocols to create a driverless and open standard that, like wireless Ethernet will "just work" in the majority of use cases. AVB was developed to add three major improvements to the current 802.11x protocol:

1. Precise timing to support low-jitter media clocks and accurate synchronization of multiple streams,
2. A simple reservation protocol to allow an application on an endpoint device to notify the various network elements in a path so that they can reserve the resources necessary to support a particular stream, and
3. Queuing and forwarding rules that ensure that such a stream will pass through the network within the delay specified by the reservation. [1]

For example, A MOTU AVB audio interface, when connected by CAT5e to any Mac Mini, will self-configure, and all the input/output channels on the device will be registered automatically with Apple Core Audio without the need to install drivers. Since PD also "speaks" Core Audio, it is simple to write a program which associates input and output channels with the artists PD code. This could even be scriptable with python. So for example, when the artist from the example above emails the eight channel composition as a PD file to the Museum, when the curator plugs in a Focusrite AVB interface, the input output channels are automatically registered with core audio, the Pure Data python script finds and maps the inputs and outputs it needs automatically, and the piece is ready to go. Of course there will always be some gain and EQ adjustments needed for pieces performed in different venues, but the promise of AVB is that the time saved in not struggling with driver downloads, USB latency issues, etc will make these types of performances far easier. And since AVB is an open standard it will be possible to amend the standard as we gain experience with what is needed for truly seamless setup.

The current AVB standard allows for 100 audio channels at 24-bit, 96k, distributed over seven AVB enabled switches, with guaranteed quality of service (QoS), sample synchronous output, and latency measured in the low microseconds, vs. milliseconds with Firewire or USB audio interfaces. This was calculated using the AVB Bandwidth Calculator written by Jeff Koftinoff which can be found at https://abc.statusbar.com/.

The Promise

The promise of AVB is not just that it can standardize Firewire and USB audio interfaces. Because it is based on Ethernet protocols, it becomes possible to utilize much larger channel counts for sophisticated next generation multimedia artistic compositions. For example, the "state of the art" computer interfaces currently max out at about 20 input and 20 output channels, while video tops out at about 5 channels for a single computer with multiple video cards. The technology for creating a 128 channel multimedia works exists but is prohibitively expensive for experimental or student artists. For example the Meyer Sound LCS series, utilized by Cirque du Soleil, can provide up to 500 audio input and output channels but the cost is in the mid six figures. Trying to use multiple interfaces on a single computer is an exercise in frustration, and there is no guarantee of latency or sample synchronicity.

There are some commercial, proprietary systems for high channel count audio systems (Cobranet, Dante, etc), but as single company proprietary standards they inhibit the emergence of a full interoperable ecosystem of devices. They require specialized driver downloads and sometimes need that company's hardware, not to mention they are extremely expensive. Therefore they are not very useful for the creation of multimedia and multichannel artistic compositions.

AVB will enable artistic compositions with hundreds of channels of audio playback and hundreds of channels of audio input or gesture input. It uses a distributed network of devices to play back media content with high fidelity and excellent user experience. Basically it lets users place audio devices and video devices wherever they want, and use the network to distribute and synchronize the resulting rendering. [2] Of course experimental multimedia is not the driving force behind AVB, it will have applications in any kind of system which needs to transmit time-sensitive data. The automotive industry is especially interested in this protocol as a way to control cars from a distance. [3]

AVB is an emerging technology; it has growing industry support, but it is not yet mature. As early adopters we have the chance to request features from the engineers working on this exciting new standard for content creation and content delivery with accurate time synchronization. Our demo will show a fully implemented multi-channel AVB system.

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