REAL HD-AUDIO

High-Resolution Metadata and Digital Interconnects: An Interview with Jeffrey Barish of 3beez

Dr. AIX's POSTS — 02 September 2016

By Mark Waldrep

You may have noticed a banner ad from 3beez on this webpage. 3beez founder and president, Jeffrey Barish reached out to me some months ago via email and it seems we're on the same page on many issues relating to high-end audio (cables, DSD, and more). So I offered to interview him regarding his present efforts in the area of "music management". I think you'll find his initiative worth checking out.

Jeffrey Barish has developed a "music management system" called 3beez. He has been involved with digital audio for over 40 years and has several startups under his belt, including Sonic Solutions, where he invented the NoNoise system, and EuPhonics, where he developed software for audio effects and music synthesis for the computer and semiconductor industries. His product may be interesting to readers, but in any case his comments about how interconnects can affect sound quality should be.

MW: Can you tell me what a music management system is?

JB: I coined the term "music management system" to describe our Wax Box system because that phrase accurately describes what the system does. It produces music, it manages the music by storing and cataloging it, and it is a complete system, not a hardware or software component that needs other components to provide all the functionality required to enjoy a collection of digital music.

We believe that most music lovers appreciate the simplicity and elegance of a self-contained system. There are no issues with interoperability of separate components made by different companies. We avoid the constraints of the standards required for interoperability – UPnP and DLNA. The integrated software performs all operations required, so there is no need to select, install, and learn multiple software products. A self-contained system is easy to install. Even technophobes can set up a Wax Box and be listening to music in minutes.

MW: So it sounds like you've developed a complete solution, what else makes the 3beez system unique?

JB: Two things. First is the custom Wax software. Wax provides a uniform user interface for performing all of the operations required in a digital music system. Wax makes it easy to gather, enter, or edit metadata – as much as you want – even while simultaneously playing music. It eliminates the need to index sound files and to organize your sound files in particular ways. It eliminates "file ping-pong" – the need to bounce sound files to a desktop system to make even trivial changes to the metadata and then bounce them back. Best of all, it provides high-resolution metadata, which is our term for the rich metadata that can be stored using Wax. Having control over both the hardware and software allows us to deliver a solution that is at once easier to use and more capable.

Custom hardware is the other distinguishing characteristic. Our latest system has a custom digital interface board to improve sound quality.

MW: What are the advantages of using a custom digital interface board? Isn't managing music a software thing?

JB: Although our product has a DAC built in, we have always offered digital outputs for listeners who wanted to connect an external DAC for the best possible sound quality. In the past, we offered only asynchronous USB and TOSLINK outputs. I was partial to USB because that interface gives control of the clock driving the DAC chip to the external DAC. However, I found that we were not getting the sound quality I expected with many DACs. The fault obviously could not be attributed to corruption of the digital data because the effects were too subtle. The only other possibility was that electrical noise generated by the circuitry in the Wax Box was reaching the external DAC over the digital interconnect and corrupting the operation of the DAC. Since electrical noise is ubiquitous, DACs should

protect themselves from it, but it seems that many do not. Accordingly, I set out to design a digital interface that prevented this noise from exiting the Wax Box.

My first step was to choose the best digital format. As I said, I had always been partial to asynchronous USB, but I had also come to realize that USB introduces serious countervailing challenges. The primary rationale for using an external DAC is to isolate the sensitive DAC chip and its associated analog circuitry from the electrically noisy environment of the computer at the core of any digital music system. However, the USB protocol itself requires a computer. Moreover, the data lines in a USB interface are bidirectional, so it is very difficult to galvanically isolate them when the interface is operating at the speed necessary to support HDA. Thus, USB compounds the noise problem: Noise arriving on the interconnect still penetrates to the internal circuitry and there is additional noise being produced by the internal computer required to implement the USB protocol. Some DAC manufacturers seem to have overcome these challenges, but given a choice I wondered whether USB really is the best one.

I ruled out I2S because so few products support it. Moreover, I2S was designed to communicate between chips, not systems. That left the family of interfaces based on AES/EBU. Optical fiber ought to be best because it provides galvanic isolation automatically. However, the implementation enshrined in the TOSLINK standard has limitations (the use of plastic fiber, principally) that may increase jitter. The electrical forms of the standard avoid the limitations, and providing galvanic isolation is straightforward because AES/EBU is unidirectional. I was always wary of the need to extract the clock from the digital stream because of the possibility that the extraction could introduce jitter, but designers have solved this problem. Thus, AES/EBU was my choice as the least bad interface available.

Our custom digital interface board – we call it the "BitScrubber board" – uses transformer coupling at both its input and output for maximum common-mode noise reduction and for galvanic isolation. The line driver chip has high bandwidth and low output impedance so that it can properly drive the interconnect even at the high frequencies required by HDA. Careful layout of the PCB maintains the balance of all differential signals to maximize the rejection of common-mode noise by the transformers. Objective measurements of the noise rejection capabilities of the board, which we published at our web site, show how effective the design is. Careful subjective tests confirm that the board improves sound quality, at least with some DACs.

MW: What do you mean by "high-resolution metadata"?

JB: Just as "high-resolution audio" provides a more complete representation of the audio, "high-resolution metadata" (HRM) provides a more complete description of the music. People who care about sound quality appreciate the fidelity provided by high-resolution audio; people who care about music appreciate the enlightenment provided by high-resolution metadata. Most music manager programs provide only a little information about a recording – typically the album title, the name of the artist, the title of the track, the genre, and a date. Music lovers like to know more. For example, a jazz lover might like to know that the 1947 Charlie Parker recording "Encores" has a young Miles Davis playing on several of the tracks. An opera lover would generally want to know the cast of the opera. All music lovers might want to be able to access liner notes, and they might be interested in an image of the back cover as well as the front cover. Not everyone cares about these things, just as not everyone cares about higher fidelity, but many do.

HRM is useful for more than just supplemental information; it also aids in distinguishing recordings. The small set of common tags may be sufficient for a small collection of pop music, but HRM is essential for large collections, especially when the collection includes classical music. In my collection, I have six versions of the show West Side Story. I distinguish them by cataloging the date of the original production along with the name of the show and other things. I have 12 versions of Mahler Symphony No. 2. Without the name of the conductor, I have no way of knowing which is which. Some collectors have multiple versions of a concerto with the same soloist, conductor, and orchestra, but recorded on different occasions. HRM makes it easy to handle these situations.

The limitations of standard metadata arose because the standards were developed at a time (1996) when disk space was precious and by people who thought only about support for pop music. The most widely used standard is ID3, which is the standard for embedding metadata as tags in MP3 files. ID3 actually defines a surprisingly large set of tags, but few music management programs handle them well. You can provide the name of the conductor with ID3 tags, but doing so doesn't help if your player does not display the conductor tag.

Another problem with tag standards like ID3 is that they are too rigid. It doesn't help to have a tag for conductor when you are cataloging pop recordings. Likewise, it doesn't help to have a tag for album title when you are cataloging symphonic works. Always displaying all available tags clutters the display. With Wax, users can define the set of metadata keys best suited to each genre. That way, you get a "conductor" field only when you are in a genre for classical music and an "album title" field only when you are in a genre for pop. With flexible metadata, Wax

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can display exactly the information required to differentiate the recordings in each genre.

There are many more aspects to high-resolution metadata, but being able to define as much metadata as you want using exactly the metadata fields you want are the two essential characteristics.

MW: Don't existing media servers in conjunction with Roon solve the problems that you are describing without requiring any effort on the part of the user?

JB: Roon in conjunction with a streaming service like Spotify or Tidal is a good solution for many listeners. Together, they provide a vast selection of music and a lot of information related to the music. If you are only interested in exploring new music or in having some background music, Roon's user interface can be seductive. However, problems arise when you are looking for a particular recording or work. For example, the overview of your collection in Roon might display two versions of Pearl Jam Vitalogy. The two versions are indistinguishable in this display. You have to click on each cover in turn to get the information that one is for the standard CD release and the other is for the 24/96 HDtracks remaster. This problem gets much worse with classical music. No doubt Roon has metadata for even more than the 12 versions of Mahler Symphony No. 2 in my collection. It would be very tedious if I had to click on each cover in turn to get the name of the conductor and the orchestra.

The way that Roon handles CDs with multiple works is also problematic. Roon at least has a nicer way of displaying such CDs than iTunes does. The tracks for each work are grouped under a heading identifying the work. However, music lovers typically want to be able to survey all the versions of a particular work to select the one they want to hear, even when each version is one work on a multi-work CD. Roon makes it possible only to survey entire albums, and then only by cover art and scant metadata.

Roon does provide a lot of information about a recording under "credits". However, if I am looking for the recording of Aida with Leontyne Price, I have to click once to get from the overview display to the album display and then a second time to bring up the album credits. If I guessed wrong, I have to click twice more to get back to the overview display and then start over with the next guess.

At this time, it is not possible to add metadata. Even when Roon adds this functionality, users have to remember that any changes or additions go away when they stop paying $119 per year to maintain their license.

Roon is the latest in a succession of products that promise utopian ease in cataloging a digital music collection. Some music lovers will be satisfied, but people who really care about their music collection are always going to want more control over their metadata.

MW: Any final thoughts on the state of high-resolution music and how your system enhances the user experience?

JB: It's a great time to be an audiophile because technological advances are improving every aspect of the listening experience. It took a while to realize the potential of digital technology to provide great sound quality. As you demonstrate through your business, it is now possible through meticulous engineering and the choice of the right technology to create recordings that sound great. However, for serious listeners, listening to music involves more than just the auditory experience.

It has also taken a while to get to the point where digital technology is finally able to do a good job delivering quality metadata. Serious listeners want to be able to find their music quickly and to know things about what they are listening to: names of all the artists, background information about the composer, the venue – maybe even the name of the recording engineer. High-resolution metadata makes the listening experience complete.

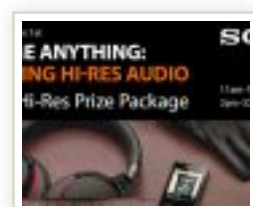📩 **Forward this post to a friend and help us spread the word about HD-Audio**

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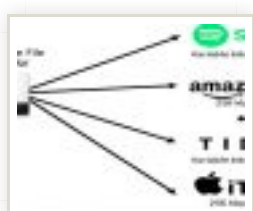
Summer's Over
August 21, 2016

Ask Me Anything: Defining Hi-Res Audio
August 18, 2016

Audio Fidelity Olympics?
August 13, 2016

August 26th, 2016

How many people can say they've swallowed a radioactive pill? It's a very strange feeling to be comfortably sitting just outside the "hot" room at the nuclear medicine basement area of the UCLA Medica [...]

Summer's Over
August 21st, 2016

My summer break is officially over tomorrow when the fall semester 2016 begins at California State University, Dominguez Hills. It's back to the classroom to welcome a new crop of eager audio students [...]

Ask Me Anything: Defining Hi-Res Audio
August 18th, 2016

If you've visited AVS Forum, you might have noticed a couple of upcoming events focused on "Defining Hi-Res Audio". The folks at Sony — the Q&A session will be driven by the primary advocate for hi-re [...]

Audio Fidelity Olympics?
August 13th, 2016

I love the summer Olympics! I've been spending a bunch of time watching them from my DVR so that I can skip all of the fluff and commercials. As a track and field athlete in high school (I was a pole [...]

Smyth Introduces the A16 Real 3D Audio Headphone Processor
August 8th, 2016

Many of you know that I have one of the original Smyth Research Room Realisers (the A8) and I have offered my studio to many of the company's customers for measurement. The device is able to convincin [...]

Your Listening Room: Absorption
August 2nd, 2016

Continuing with the importance of having a proper listening room, I'd like to continue talking a little more about isolating an individual room. Last time, I talked about things that professional stud [...]

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Chris Wright: Sending you every good wish Mark.

Michael Graves: Mark, Wow! You process must have been a bit different from mine. I was treated for Graves disease...

Admin: I've been assured that my treatment will eliminate any traces of cancer. However, if you or any of my...

FREDERIC: I am really concerned about your health. I also have a few lumps in the thyroid. I hope he recovers soon....

Ask Me Anything: Defining Hi-Res Audio (8)

Admin: The dynamic range database is a good start but it