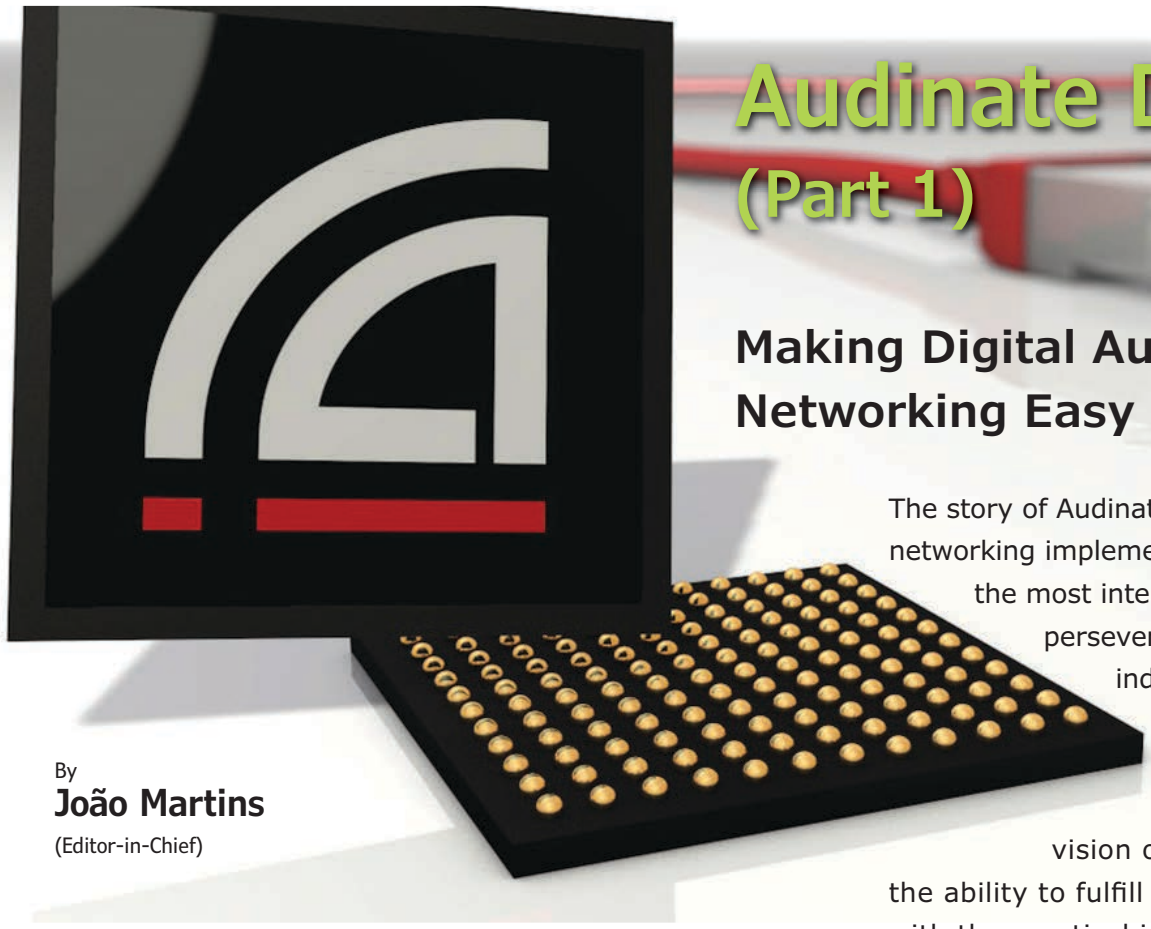

Audinate Dante (Part 1)

Making Digital Audio Networking Easy

By
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The story of Audinate and its Dante audio networking implementation is one of the most interesting examples of perseverance and focus in the industry. It demonstrates the evolution to an industry standard results from a clear vision of market needs and the ability to fulfill those necessities with the practical implementation of converging technologies.

In a two-part article series, we will explore the reasons why Dante technology became the "de facto" standard in audio networking and reveal the company's perspective of "surfing the wave" of audio over IP (AoIP). We will also discuss the company's ability to cleverly manage existing industry efforts and commercial requirements to build a unique example of marketing success. As Audinate's CEO Lee Ellison explains, because "the great thing about standards is that there are so many of them."

Built on existing networking protocols and standards, Audinate's Dante technology is a self-described "plug-and-play networking solution, which delivers synchronized media with ultra-low latency, simplifying the installation and configuration of digital media networks." Dante is currently the market's leading digital audio networking solution, adopted by approximately 150 OEMs to date (some still to be publicly disclosed). Those OEMs have already developed a unique ecosystem of hundreds of compatible products. Currently, applications that use Dante can be found throughout the pro audio live sound market. But most importantly, Dante is also reaching the commercial installation, broadcast, and recording studio segments.

The Dante networking solution became widely accepted among many pro audio manufacturers and is currently deployed in thousands of installations worldwide because of its self-configuring network architecture. Dante uses standard IP over 100-Mbps and 1-Gb Ethernet, enabling easy setup and automatic discovery of devices on the network with one-click signal routing and user-editable names.

In contrast to previously existing audio network technologies, Dante distributes digital audio plus integrated control data with imperceptible latency, sample-accurate playback synchronization, and high-channel counts. The technology reliably uses standard network infrastructures, even with high-quality digital signals in high-sampling frequencies.

As licensed technology, Dante also offers a combined hardware and software toolset, enabling

Sydney, Australia-based Audinate became a global company in just 10 years thanks to the success of its Dante technology.

manufacturers to quickly implement their own solutions while leveraging continuously improved software tools (e.g., the Dante Controller application for Windows 7 and Windows 8 and Mac OS X). This application enables manufacturers to set up, manage audio routes, and configure Dante devices in any sized network, and also enables real-time network monitoring functionalities with channel metering, multicast bandwidth usage, and clock health monitoring and event logging, which enables users to quickly identify and fix potential network issues.

But possibly the most interesting software component in a Dante solution—resulting from Audinate's IT standards approach—is the availability of the Dante Virtual Soundcard technology. The technology enables any PC/Mac connected to a Dante audio network to use a computer's Ethernet port to communicate with other Dante-enabled devices. Popular DAW applications (e.g., Nuendo, Cubase, Logic, or Pro Tools) can transmit and receive up to 64 bidirectional channels to networked audio equipment, via the Dante Virtual Soundcard, without any additional hardware soundcard.

Dante also appeals to the recording and studio markets, attracting several important new OEMs to join the Audinate licensing program. In the last two years, interesting developments in that market revealed Audinate's ability to handle new developments and implementations, working in cooperation with Yamaha/Steinberg on its ambitious Nuage post-production platform and with Focusrite on its Rednet studio platform.

Demonstrating an ability to quickly respond to existing market demands, Audinate attracted broadcast equipment manufacturers as diverse as DHD from Germany, AEQ from Spain, and NTP from Denmark, among many others. In turn, Dante became the most recognized and interoperable media networking solution in today's market. And, broadcast manufacturers are always willing to invest in their own network developments, while others prefer to adhere to standards or at least to steer existing development efforts toward those potential standards.

But even among the companies with enough resources to pursue such an endeavor, we are starting to see "signs of fatigue" while decisions are being made to quickly introduce Dante-compatible solutions, as required by its own clients.

Aviom is another Audinate licensee. Its president and CEO Carl Bader explains, "Dante has become a standard in digital audio networking for the pro audio industry, and incorporating Dante connectivity into our personal mixing system makes it possible for our personal mixers to be connected directly to many of the best digital consoles on the market. By incorporating Dante, we have both simplified the setup of systems…and added versatility for the user."

According to Lee Ellison, Audinate's CEO, "The adoption of Dante among A/V manufacturers doubled just in the past year. Our customers recognize that networking matters and having an interoperable, proven networking technology to get to market quickly has enormous benefits."

The IP Formula

To understand how Audinate surpassed competing existing network technologies propositions and thrived when discussions about the need for industry standards in media networks are prevalent, we interviewed Audinate CEO Lee Ellison.

Ellison brought to the company more than 25 years of executive leadership experience that encompasses

Live sound was the first industry segment targeted by Audinate. Working in cooperation with companies such as Yamaha, the Dante network audio technology became essential. (The Yamaha CL Series is pictured.)

Dante Controller is a free software application for Windows (7 and 8) and Mac OS X. It can be used to set up and manage audio routes in a Dante audio network and configure Dante devices, providing real-time network monitoring functionalities.

a broad range of technology sectors including software, computer, and telecommunications. His experience enabled him to quickly become an industry spokesman on all media network-related subjects.

As Ellison is quick to instantiate when we refer to Dante's success as a "de facto" standard, "we are becoming an enabling technology, rather than a competing technology. We are enabling things that could have never been done before…

"Maybe the reason is that, from the beginning, we architected Dante looking at using the IP technology as a foundation, unlike other companies who approached this industry in the past. Primarily, those were audio companies developing another network technology, while we are not an audio company, we are a networking company. We have also the largest engineering team out there with a background on all various forms of networking, so that's why we where able to do that.

"We knew there would be some additional challenges and more stringent requirements in transmitting uncompressed audio. From the beginning our initial focus was really the Live Sound. Commercial installation is a larger market than Live, but we felt we could address the more stringent requirements of live sound and we knew we had an architecture from the perspective of being a scalable platform, because we were using IP."

But this is not the entire story. Essentially, Audinate responded efficiently to a diversity of requirements and different goals from the manufacturers that approached the company. Audinate showed it could answer the key challenge of conflicting requirements (e.g., latency, number of channels, and higher sampling frequency), without compromising the IP and networking standards approach.

It's important to understand what was in question here and how the industry handled those dilemmas.

Dante uses automatic device discovery and Zero Configuration Networking—Internet Engineering Task Force (IETF) Zeroconf protocols.

A Little History

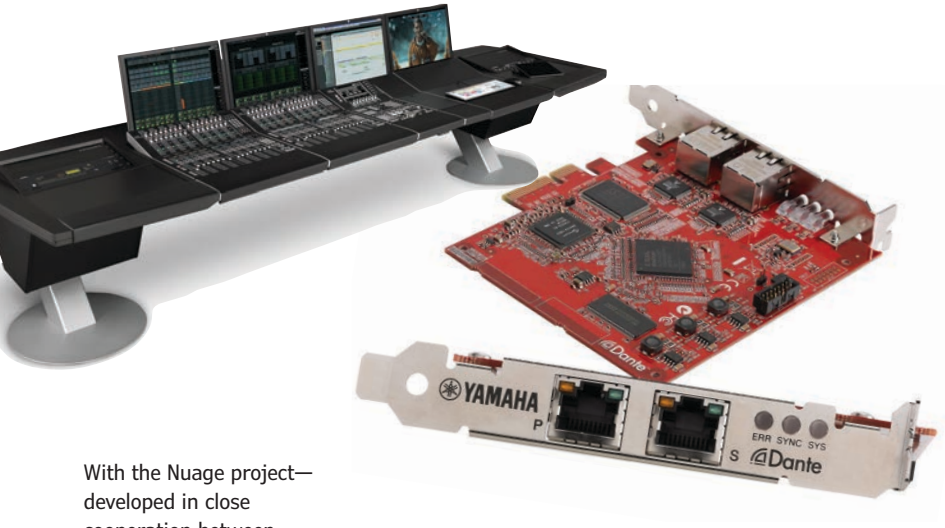
In the analog domain, the main concern dealt with noise interferences and audio signal degradation from long cables. With the adoption of computer networks, the focus evolved from the simple transmission of digital audio signals in point-to-point, to finding the best way to efficiently distribute and route audio without compromises in quality—if only using, in practice, the Ethernet physical layers.

From standards such as AES/EBU (currently AES3), a multichannel version was created and Multichannel Audio Digital Interface (MADI) AES10 became the first solution to enable large routing systems and the distribution of up to 56 channels (later expanded to 64 in the 2003 revision). The hardware was expensive because it was based on coaxial cable, but the possibilities still generated interest, especially for use with broadcast applications.

Other digital point-to-point audio transmission interfaces, such as TDIF and ADAT, survived for quite some time together with AES3 and MADI, but they required dedicated cables. Digital signals were "transmitted" or distributed point-to-point in most of the applications. But it become apparent that creating a true network topology, in which the signals can be routed freely to any number of points with bidirectional flows of independent data sharing the same infrastructure, made sense. The flexibility this would enable encouraged many R&D departments to start examining solutions that would use standard Ethernet network switchers, routers, and cabling.

Audio Engineering Society (AES) convention exhibitors have demonstrated such systems since 2000. Among them was Sony's demonstration of the Pro-Audio Lab Oxford (2003) of SuperMac (10/100 Mb) and HyperMac (1 Gb), which were later recognized as the AES50 standard (2005). The technology was later sold by Sony Oxford to Klark-Teknik. Today it serves as the foundation for the successful range of Midas and Behringer (The Music Group) digital consoles and live sound solutions.

Interestingly enough, the technology was introduced as a "multichannel audio interconnection" solution running on CAT-5/6 concurrently with control data and (potentially) enabling independent



With the Nuage project—developed in close cooperation between Yamaha, Steinberg, and Audinate—the Dante technology was brought to another level. An example of the implementation is the Dante Accelerator audio interface card for the Nuendo DAW, which provides extra low-latency transfers of as many as 128 simultaneous channels of 24-bit/96 kHz audio (64 channels at 192 kHz) plus redundant Gigabit connections.

audio channel switching and routing using low-latency TDM technology. The technology was a proprietary implementation in terms of networking protocol, but was converted to an open standard and temporarily supported by companies (e.g., Merging Technologies and SADiE) for studio and post-production applications.

The impact of this implementation was that it demonstrated the benefits of moving away from the typical packet-based Ethernet systems because of the latency in favor of higher sampling frequency support (up to 96 kHz) and frame synchronization. The AES50 approach only used the Ethernet technology's physical layer—the cables and transceivers at each end—creating point-to-point transmissions within the generic network infrastructure. The change enabled a more efficient use of the available bandwidth, which made the technology incompatible with off-the-shelf IT equipment.

Simultaneously, competing technologies were adopted in the market. The main one was EtherSound from the French company Digigram. EtherSound used a daisy-chain topology, in which all the devices, including standard IT switchers, could be connected on a continuous string of signals running over Ethernet with "deterministic" latency. That is, the full network, once running, achieved the same low latency in all connected points. The problem was EtherSound was never fully developed as promised, including a star architecture, and it remained dependent of single points of failure in a daisy-chain structure. EtherSound for Gigabit Ethernet (ES-Giga) was promised in 2006 but it was not compatible with previous implementations.

CobraNet, a technology developed originally by Peak Audio in the 1990s and later by Cirrus Logic, was a different approach being developed around the same time as EtherSound. In this implementation, the signal routing was determined by network software and not the network devices. The technology used real audio distribution over Ethernet, unfortunately at the cost of latency. It was designed for large, fixed commercial installations where it was not an issue to have more than 5 ms. CobraNet uses standard Ethernet technology (IEEE 802.3) for audio transport, transmitting to Layer 2 to distribute up to 32 channels to and from each CobraNet device over a single Cat-5. Unfortunately the solution was fairly complicated in terms of network management and was designed for people with extensive IT knowledge and network administrators. It was also limited to 100 Mbps Ethernet.

Recently, we have started to see more advanced implementations in audio networking over IP/Ethernet for studio, live broadcast, and live sound, which manage different requirements in terms of bandwidth,

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latency, and synchronism. Examples include QSC's Q-LAN in the commercial installation segment, Axia Livewire in the broadcast radio market, Riedel Rocknet in the Live events market, and industry efforts such as Audio Video Bridging (AVB—IEEE 802.1) and Ravenna. Even with the first practical implementation demonstrations, which were supposed to be based on existing standards, experience has shown that it is not easy to make AoIP routing that enables the use of low-cost off-the-shelf IT components while using advanced Layer 3 Ethernet implementations.

At the same time, Ethernet is quickly evolving from 1 to 10 Gbps. With 40- and 100-Gb equipment promising to become a market reality very soon, there is a clear demonstration of the importance of building audio network technologies on top of existing networking standards.

Figuring It Out

Ellison explains how all those requirements were put in perspective with Dante. "One of the early technologies was CobraNet, but it had a really high latency and that was the reason why it never took off in live sound. That's why EtherSound did OK for a while, but they had this daisy-chain ring topology and it didn't scale well. You couldn't use it in a convention center or an airport…

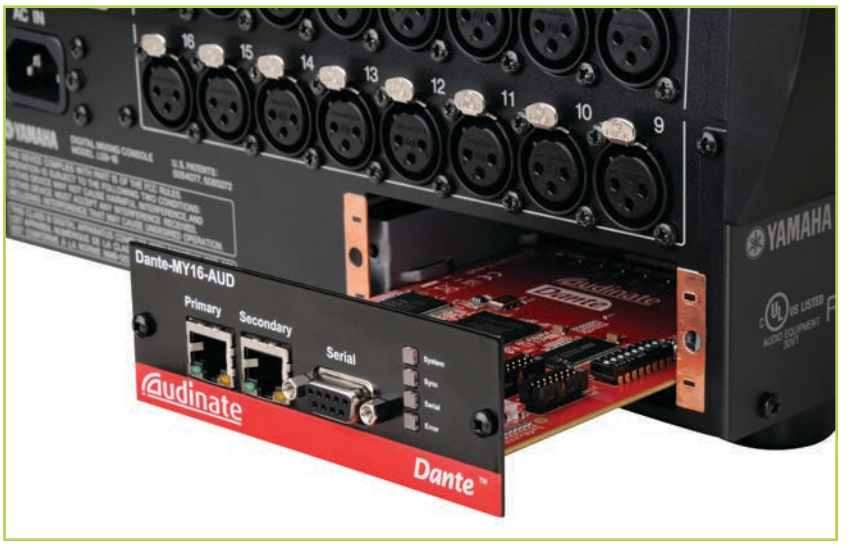
"The way we did it, was figure all that out by using the right kind of clocking mechanism. By using clocks that had precision time protocol and that where accurately timed to one another, within plus or minus 1 µs, we could solve a lot of those problems. Other technologies where also always limited to 100 Mbps. They could never go beyond that, and network speed/bandwidth is your friend when it comes to latency. Depending on the manufacturer, some might setup a small point-to-point system at 250 µs, were as, you might typically setup the rest of your network for 1 ms and we were able to achieve that. For monitoring purposes, you would try to set it up to be very short, where as for the rest of the system you would try to put in a millisecond and have everything else transmit plus or minus one microsecond.

"We can also support multiple sample rates in the same network and doing those kind of things. We are also developing improved health monitoring information and helping the person understand the network. We know there are other competitive technologies. Usually, we know that if companies put enough engineering people on a project—and there are good enough people and they are directed in the right direction—you can potentially do that, if their background is on networking. We are the largest company doing this for this industry by far. By far! What a lot of the senior management in these companies are realizing is 'why should they develop a technology themselves, which at the end of the day isn't as good as Dante is, cause they are stealing those resources away from their core competencies that differentiate their product to make really cool professional audio equipment. I think people understand the argument of 'build versus buy.' Once we build it, it continues to change and evolve and we are always doing new things to it and that is one of the benefits our customers get from Audinate and the reason why our customers stand behind us."

Dante has already started to make inroads in the studio and recording market with Focusrite and the RedNet range of modular Ethernet-networked audio interfaces, even bridging between Pro Tools|HD or MADI systems and any Dante audio network.

Another key factor for Audinate growth is that the company was intelligent enough to learn from previous experiences and work with the implementers of other technologies, as Lee Ellison acknowledges, although clearly separating the "implementers of an existing technology," from the "creators."

"We work with great implementation partners and we have authorized implementers, like ZP Engineering and Attero Tech. We like to work with really experienced implementers. Auvitran did some work—and they were the guys behind EtherSound; and Attero Tech where among the largest CobraNet installers—so we work with great authorized implementers who help our customers layout the products quickly and get to market quickly." ax



The Dante-MY16-AUD card is a fully compatible Yamaha Mini-YGDAI standard card that instantly Dante-enables any Yamaha console mixer, processor, or power amp with 16 bidirectional audio channels and full Dante network audio redundancy over Gigabit Ethernet.