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■ **Dante makes Digital
Audio Networking Easy**

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Dante: Digital Audio Networking Just Got Easy

This white paper addresses the case for shifting from an analogue distribution network to digital networking. The paper discusses the benefits of digital networking, the weaknesses and limitations of products by other vendors, and the unsurpassed quality advantages that can be provided by Audinate's Dante technology.

Audinate's Dante networking technology was developed to make professional audio networking easily accessible for both AV and IT professionals. Dante adds significant value to installed sound, live sound and professional audio products of every type and category. Running on standard Ethernet/IP networks, Dante's powerful network configuration and management functions make plug-and-play networking a reality.

Challenges Of Designing Analogue Audio Networks

Analogue audio distribution systems still dominate audio installations in the live and installed sound markets. Most audio professionals are still using point-to-point wiring, even though it is cumbersome, error-prone and expensive. Implementing a complex audio system based on analogue distribution requires careful design which must be undertaken in advance.

This creates challenges for both the designer and the system installer. Designing to meet the needs of the initial project, as well as future proofing for anticipated and un-anticipated changes cannot always be achieved technically or economically. Analogue audio requires a physical copper cable for routing each signal, and offers little flexibility to accommodate unplanned changes. Moving or adding equipment in a location will add significant costs as AV



Lords Cricket Stadium in the UK

system integrators need to run separate conduits for signals of differing voltages and pull heavy copper wire through them.

In professional live sound systems, production rental houses are still trucking multi-core "snakes" that weigh hundreds of pounds. Analogue wiring is noisy and long runs degrade signal quality noticeably. At the

end of those runs, connections have to be made - and checked, and often re-checked and re-made.

Certainly low latency is an important requirement in high quality audio. Although analogue audio transmission involves virtually no latency, other factors can adversely affect sound quality.



One of the largest Dante jobs: The Queens Jubilee



Campus Riedberg of the Gothe University in Germany completely networked using Dante

Analogue wires act as antennas carrying low-voltage signals — radio signals can become audible. “Ground loops” can introduce hum induced by AC power lines. Long cables are capacitors that attenuate high frequencies. These effects combine to raise the noise floor of the system, making it harder to deliver high quality sound to the audience and the performers.

Of course the production of audio has gone digital. Most pro audio products digitally process audio data — digital audio networking eliminates multiple and sequential A/D (analogue-to-digital) or D/A (digital-to-analogue) converters that are required when digital devices are connected with analogue copper wiring. Each converter delays and adds distortion to the signal and the cumulative effect may be audibly noticeable. Digital networks are largely immune to these problems. On a digital system, the input signals can be pre-amplified and converted to the digital domain as close as possible to the actual source. The signals are then processed and transmitted digitally throughout the network. The result is a much cleaner audio signal with a lower noise floor.

Benefits Of Digital Audio Networking

Digital audio distribution significantly reduces implementation costs saving time and money, while providing better performance than analogue wiring. By allowing many signals to be carried over the same link, digital audio distribution eliminates masses of bulky, heavy, expensive, and inflexible copper wires. Installation is made simple using digital networking; a single lightweight, inexpensive

CAT5 cable connected to a piece of audio equipment can carry all the required inputs and outputs as digital audio data.

IP (Internet Protocol) over Ethernet is the technology used for computer networks and the Internet. Often referred to as TCP/IP networking, it is the most widely deployed approach to networking and represents the best available foundation technology for media networking. Switches, CAT5 cable and other hardware components used to build such networks are mass-market items. Their costs are continually falling at the same time as their feature sets and performance are growing.

IP over Ethernet has many practical advantages that can be applied to audio networks. With Dante, existing infrastructure can be used for high performance audio as well as for ordinary control, monitoring or business data traffic. Digital networks utilize standard Ethernet over IP offering high bandwidth capable of transporting hundreds of high quality channels over 100 Mbps or 1 Gbps Ethernet. Set-up and configuring the system is made easy as well, saving enormous installation costs and long term cost of ownership on a digital network. The physical connecting point is irrelevant: audio signals can be made available anywhere and everywhere. Patching and routing are logical functions configured in software, not via physical wired links.

Dante Media Networking Offers Improved Performance Over Other Audio Networking Solutions

Dante is a patented technology, developed

by networking experts. Rather than side-stepping network standards as earlier development teams did, Audinate developers applied their expertise to leverage Ethernet and IP standards. As a result, Dante networks solve problems with outstanding performance, superior flexibility and unprecedented usability.

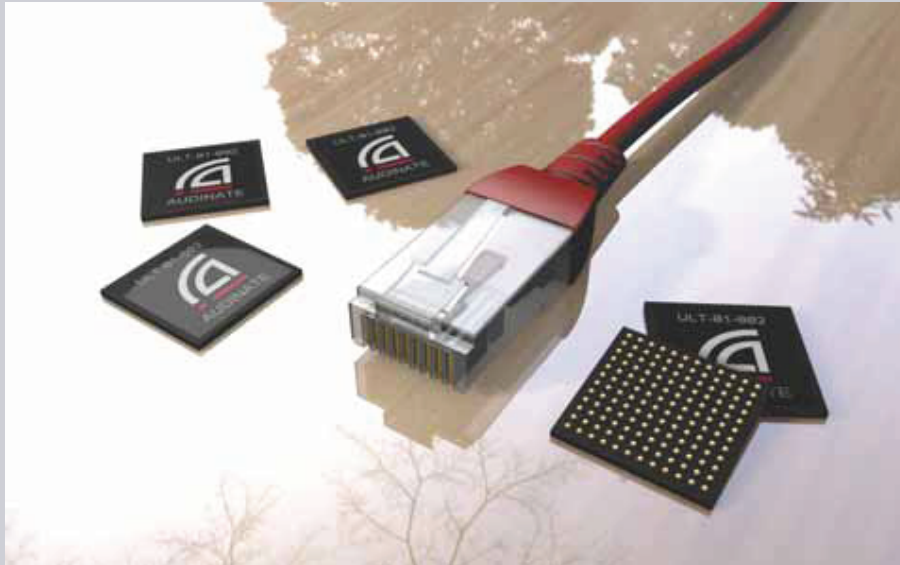
Dante appears to an Ethernet switch or an IP router exactly like any other standards-compliant data, because it carries media data in standard UDP (User Datagram Protocol)/IP packets. All computers use IP and can be easily connected to Dante networks. Because it works within the standards framework, Dante is the first solution to fully leverage the price and performance benefits of both 100 Mbps and 1 Gbps switched Ethernet networks. Control data and media data can travel on the same network - in fact, Dante can deliver high-bandwidth, uncompressed digital media streams over existing networks that are simultaneously carrying TCP (Transmission Control Protocol)/IP traffic such as Email, Internet browsing and other office data.

• Zero Configuration Networking: Plug-and-Play Networking With Professional Performance

To radically simplify network set-up and configuration Audinate built on its deep expertise in Zero Configuration Networking, which was originally developed to allow people without special networking expertise to connect computers and printers over TCP/IP networks. It removes the need for special infrastructure, like Dynamic Host Configuration Protocol (DHCP) servers and Domain Name System (DNS) servers, or having to set up each computer's network settings manually, which would be difficult and laborious, especially for non-technical users.

By extending the capabilities of Zero Configuration networking (also known as Zeroconf) into the audio application domain, Audinate has made it possible for all Dante-enabled devices on the network to automatically discover each other and configure themselves, as soon as they are connected to the network. This self-discovery technology makes Dante networking a true plug-and-play experience.

Each audio channel can be labelled with a logical, descriptive name instead of an incomprehensible number. Text labelling makes it easy to assign the correct signal to any mixer or signal processor input. Labels are stored in devices and persist when the



Dante Ultimo is a fully featured chip providing a complete, ready to use Dante interface for networked audio products requiring low-channel count support. High integration minimizes component count, reduces costs and enables space-constrained networked devices. Ultimo brings Dante networking to the widest range of products.

power is turned off; network components can carry default labels that can be overwritten or augmented.

• Truly Distributed Systems Make Splits Easy

On a true network (as opposed to a digital point-to-point connection), every signal can be made available anywhere on the network and all inputs and outputs can be available at the same time. In practice, this can place extreme demands on network bandwidth. Signal processing can be distributed throughout a true network, instead of being concentrated at a central device. For example, performers can assemble and adjust their own monitor mixes without special attention from the monitor engineer. Many performers shy away from complex technology, so it is critical to make audio networking simple for these end users. Zen makes plug-and-play networking available to anyone, even non-technicians.

• Easy Integration Of Computer-Based Audio Equipment

Dante is built on IP over Ethernet — the technology your computer already uses to network with other computers, printers, etc. With Dante Virtual Soundcard for Windows or Mac OS, a software DAW (Digital Audio Workstation) running on a laptop computer can be connected to a Dante network without additional hardware and used to add effects or EQ, or as a multi-track recorder. Input and output channels to and from the DAW are assigned in software - again, no patching is required.

• Sample-Accurate Playback Timing

Dante synchronizes local clocks in each networked device to a master clock with very high accuracy. Dante clock synchronization is completely independent of the audio data and the sample rates being used on the network. The local clock is used to timestamp network packets and to control the rate at which audio samples are transmitted and received. Audinate's FPGA Dante implementations can achieve unparalleled accuracy: clock synchronization within as little as 1 μ s (microsecond: one-millionth of a second), enabling sample-by-sample synchronization of audio playout from different devices on the network.

Dante: Meeting The Needs For Today And The Future

Audinate's Dante technology has been designed, since its inception in 2003, to be fully compliant with global networking standards including IEEE Ethernet and clock synchronization standards and Internet Quality of Service (QoS) and media transport protocols. Dante also offers a future-proof migration path to support emerging networking standards.

The Audio Video Bridging (AVB) group in the IEEE has developed standards that are closely aligned to the transport technologies that Dante already uses today. Audinate supports the adoption of AVB standards and is a Promoter Member of the AVnu Alliance, an industry forum dedicated to promoting the adoption of the IEEE AVB standards.

Many Dante products are upgradable in the field so that they can track these standards as they evolve. Dante will incorporate AVB whilst retaining its ease of use, comprehensive feature set and its ability to operate over current networks. This approach de-risks the design and manufacture of networked AV equipment as well as supporting deployment of high performance AV networking on today's networks.

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The California State University in Santa Barbara, US, with a rack of Focusrite RedNet units