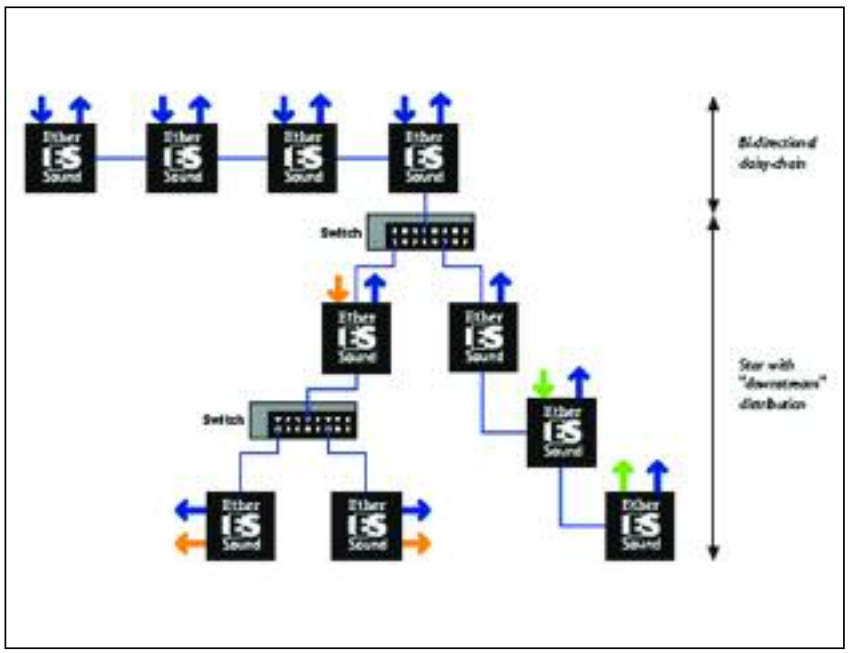
Another Way

EtherSound leverages digital progress

By Carl Conrad

EtherSound provides deterministic, real-time transmission of synchronized audio channels and control data over standard Ethernet. Introduced in 2001, the technology has been adopted by numerous partners on the manufacturing side.

All of these manufacturers produce their own EtherSound-compliant products, which can be combined into multi-vendor networks. Using EtherSound, 64 channels of 24-bit/48-kHz PCM audio, plus embedded control and monitoring data, are transported via a dedicated 100-base-T Ethernet network. Each channel is distributed independently.



Combination of bi-directional daisy-chain and star architecture.

EtherSound has built-in clock recovery for ultra-low jitter. Because jitter is the main source of degradation in uncompressed digital audio streams, this helps EtherSound deliver truly accurate digital copies of the original source.

With individual channel assignments, plus the ability to use daisy-chain and star topologies separately or in combination, EtherSound offers flexibility in configuring or re-configuring digital networks to meet the demands of specific applications.

Because EtherSound is fully compliant with IEEE 802.3, anyone using it can leverage the R&D investments made by IT giants such as Cisco, 3Com, or Hewlett-Packard for the benefit of the pro audio industry. Instead of requiring proprietary (and costly) routing devices or converters, EtherSound networks use standard Ethernet switches, media converters, etc. along with CAT-5 or CAT-6 copper wire or fiber optic cable.

Following the Ethernet standard, the maximum distance between two devices in an EtherSound network is 328 feet (100 meters). Intermediate transceivers or fiber optic links might be used to increase this distance to two kilometres (1.24 miles).

EtherSound can also run within a VLAN (Virtual Local Area Network) and share the infrastructure of existing data or video networks. If the cable is

in place, as it is in many modern buildings that are pre-wired with excess capacity, an EtherSound network can plug right into it.

This was the case recently at Centre de Congrés Montreux, where Ethernet cable installed since 2001 was used last summer to link the Stravinsky and Miles Davis concert halls. The audio distribution was reconfigured for the Montreux Jazz Festival in half a day: the previous analog system required four days of preparation time for the same event.

Minimizing Latency. Low latency is critical for live performance digital audio networks, especially now that smaller venues and portable system owners are beginning to take advantage of the inherent efficiencies and cost savings. Where the performers and/or the audience are separated by distance, building structures or both, latency is not an issue.

In a stadium or arena, the typical pre-recorded program feed or announcement from the control room can take its own time to reach the loudspeakers and the audience. But when a live event stage is erected at one end of the venue, both the performers and the audience need to hear reinforced sound from the house and monitor systems in real time. If the audio network delays the signal above the threshold of audibility, it becomes unusable.

Thus minimizing latency was a key design requirement. The end-to-end transmission time between a network input and a network output is six samples, or 125 microseconds at 48 kHz. EtherSound's latency is independent of the number of channels transmitted. Every device between the network input and network output introduces latency, but each daisy-chained EtherSound module adds less than 1.5 microseconds, while switches contribute 2 to 20 microseconds.

Further, more complex EtherSound networks operate with a network latency of less than half a millisecond – well below the threshold of audibility for critical listeners. In a system including microphones, loudspeakers and other analog devices, the biggest contributors to overall system latency are the analog-to-digital (A/D) and digital-to-analog (D/A) converters.

For example, when Solotech (a touring sound company based in Montreal) evaluated "digital snakes" that would be compatible with their Yamaha PM5D consoles, they found that an EtherSound-enabled system using products from NetCIRA by Fostex and AuviTran allowed them to achieve a total network latency of just 2.8 milliseconds, with 2.5 milliseconds coming from the console itself.

Solotech's EtherSound touring rigs consist of Yamaha PM5D mixing consoles with four AuviTran AVY-16ES cards, eight NetCIRA MS-8 AES/EBU inputs, and two NetCIRA MS-8 AES/EBU outputs. Eight Yamaha AD8HR Mic/Line pre-amps perform the analog-to-digital conversion, and the MS-8 AES/EBU encoders connect to the EtherSound network. All 64 channels of PCM-encoded data then travel on a single Ethernet cable to the AVY-ES16 cards in the PM5D's.

Keeping Pace. Ethernet technology is evolving as rapidly as other central components of the computer industry. Gigabit Ethernet (which will allow EtherSound to handle more audio channels and more data) is on our doorstep, wireless technologies are developing apace and equipment prices continue to fall.

EtherSound will be able to piggyback on these developments and

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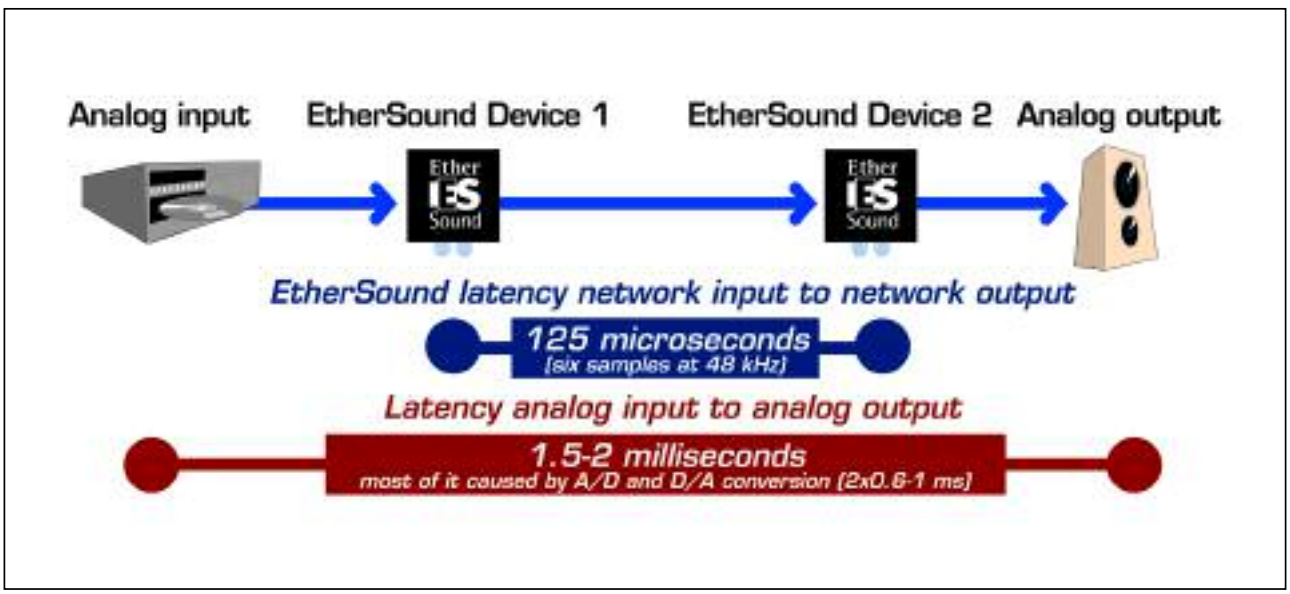

constantly increase its capabilities. This is possible because the core of the technology is a Field Programmable Gate Array (FPGA) rather than an Application-Specific Integrated Circuit (ASIC). ASIC capabilities and functions are "hard-wired" into the silicon.

Upgrading network performance requires a completely new ASIC, which in turn requires a lengthy design/test/fabrication cycle. The EtherSound FGPA can be re-programmed in the field, so manufacturers of EtherSound-enabled products can offer firmware updates and upgrades to their customer bases.

The flexibility of FPGA-based design came to the fore last year at PLASA, when a major extension to the EtherSound specification was announced simultaneously with its first implementation. EtherSound enables bi-directional audio distribution over a single cable, as well as higher sample rate conversions at 88.2, 96, or 192 kHz.

Depending upon the sampling frequency the maximum channel count per cable may vary, i.e. 32 channels at 96 kHz, but the very low and predictable latency (125 microseconds) remains unchanged. It is up to individual licensees to decide when and how to implement extensions of the EtherSound spec.

As this is written, AuviTran has upgraded its AVY16-ES card for Yamaha digital mixers (and other professional audio products using the "mini-YGDAI" interface) to a bi-directional device. Digigram has upgraded its ES8in, ES8out, ES220, and ES220-L audio bridges. NetCIRA by Fostex debuted its MS88 bi-directional encoder/decoder at Integrated Systems Europe in January.

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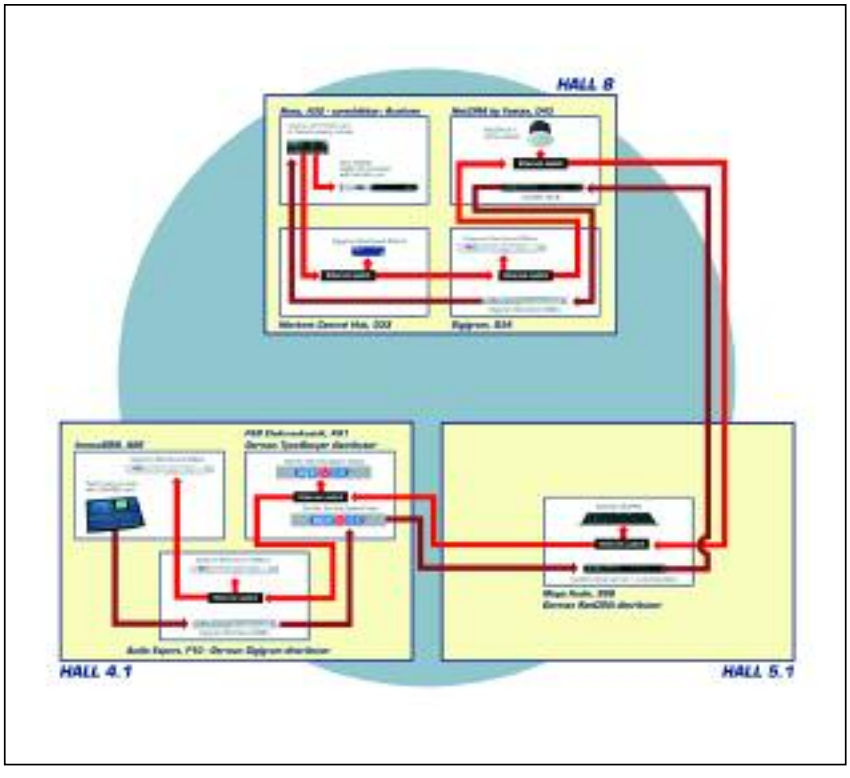

How it looked at PLASA 2004 where multiple devices at various booths around the show floor shared the same EtherSound network.

EtherSound eliminates the need to bring all of the audio to a central switching or routing location, reduces cable, conduit, and installation expenses, and simplifies system reconfiguration, as every input can be routed to every output.

EtherSound allows the creation of a virtual bus between daisy-chained devices – 64 channels of 24-bit/48 kHz audio are available at the inputs and outputs of all connected devices, regardless of the device's position on the network. Control and monitoring data are bi-directional and use the same cable as the audio.

In addition, a central computer is not required, since all connected devices identify themselves to the network automatically and most EtherSound devices have onboard signal routing functionality. The number of EtherSound devices is limited only by the needs of the application, as more than 60,000 devices can share the same network.

EtherSound embeds control and monitoring data in the EtherSound frame, eliminating the need for separate cables for the control and monitoring of equipment. The entire network, including specific functions of the various EtherSound devices, can be configured, monitored, and controlled from a single point (the mix position, for instance) using PC software or microcontrollers.

In order to facilitate the development of control applications, the

EtherSound Software Development Kit (SDK) includes an API (Application Programming Interface) which provides easy control of the connected devices, including GPIO and RS232 management, via a vendor-independent set of commands. EtherSound licensees may extend this API with proprietary libraries to control advanced functions of their equipment.

This openness was the reason software provider Stardraw.com recently formed a strategic partnership with Digigram. Stardraw Control, now in beta, which offers a software-based, unified control framework that can manage any type of addressable equipment from any manufacturer over any communications infrastructure. For systems integrators, this open, unified approach means that a single application can control diverse EtherSound products.

AuviTran's ESMonitor Software is another example of EtherSound's possibilities. It allows for remote control of Yamaha devices using Yamaha's standard StudioManager software through a virtual MIDI connection over the EtherSound network.

Development Support. For manufacturers, choosing a network standard is becoming a necessity. The benefits of digital audio transmission are increasingly clear to system integrators, rental companies and their clients.

The EtherSound licensing program has been set up to offer assistance. Authorized EtherSound Implementers (France-based AuviTran and U.S.-based Lab X Technologies, as of this writing) can help manufacturers reduce time to market and minimize the diversion of in-house development resources.

EtherSound has proven to be an effective way to bring the benefits of digital audio distribution to both fixed and portable live sound situations. We believe the technology and associated licensing program offer advantages for end users and manufacturers looking for a digital audio approach. ■

Carl Conrad is product manager for Digigram EtherSound. Reach him at conrad@digigram.com.

Double Your Fun

At the end of 2004, Digigram released the EtherSound miXart 8 CN card, which links CobraNet audio networks with the direct-to-disk audio record/playback capabilities of EtherSound.

The miXart8 has eight mono (or four stereo) analog input/output paths, including four microphone preamps with phantom power supply on its input bank, and it also includes parametric EQ, compression, gates and expansion.

The CobraNet interface is managed via an internal daughter board. Eight channels of CobraNet input and eight channels of CobraNet output are provided, operating independently of the analog inputs/outputs.

The network connection, using standard 100-Base-T Ethernet protocols, is available on two, redundant RJ45 jacks which provide on-board backup for critical applications.