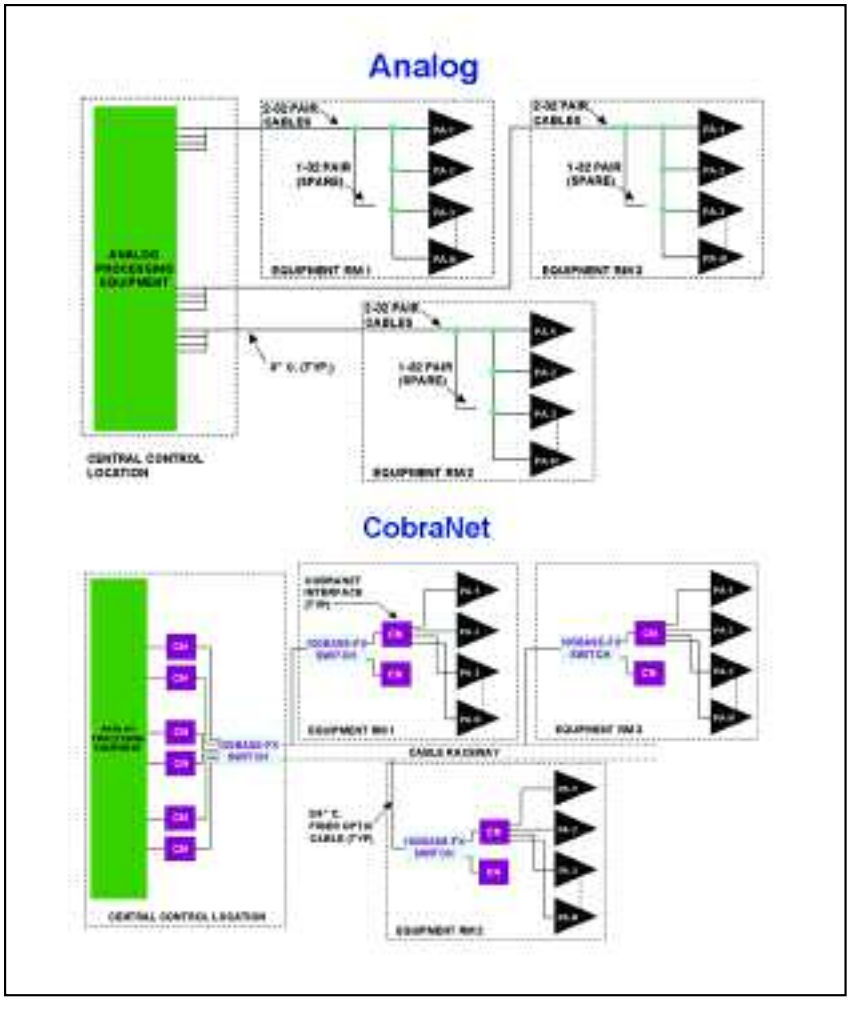
Moving Forward

CobraNet's steady evolution of inclusion

By Ray A. Rayburn

Given what audio engineers and equipment designers know about digital audio networking, it is hard to imagine why anyone would design an analog audio system today. Ironically, it's still common to see audio distribution and interconnection done in analog.



Comparison of a large-scale analog system to one using an Ethernet-based audio network.

Two underlying reasons audio designers hold off on adopting digital audio networking are 1) the absence of approved standards, resulting in a flood of proprietary and incompatible solutions; and 2) high per-node costs, which have limited the market's size and scope.

Cirrus Logic (Peak Audio) CobraNet technology is evolving to resolve both of these key issues.

Ethernet is the dominant worldwide standard for local-area networking. The most flexible and cost-effective digital audio networks use Ethernet protocols as the primary architecture for providing system setup, control and administration.

While Ethernet is the foundation for efficiency and interoperability in an audio network, analog audio signals can't simply be converted to data and transported over a standard Ethernet network. This is because audio is highly time dependent. In an audio network, late delivery of data packets will result in audio dropouts and discontinuities – in short, "choppy" audio.

Ethernet is an asynchronous technology, so it has little concept of real time. Ethernet is also "non-deterministic" in managing traffic on the network, meaning that there is no absolute guarantee that any given packet of data will be delivered over the network in a timely fashion. A

properly functioning audio network needs to have some type of deterministic timing mechanism.

CobraNet technology has been designed to provide this mechanism. The physical infrastructure of a CobraNet network is a standard Ethernet network. However, CobraNet technology allows isochronous, or softclocked, data streams to be carried over the network. (Isochronous streams are time sensitive or deterministic.)

CobraNet accomplishes this by adding its own set of rules on top of the normal Ethernet rules. One CobraNet device on the network acts as the "Conductor" for all the other CobraNet devices on the network. The Conductor sends out "beat packets" that keep the entire network synchronized, and serves as the master controller for the audio network. Audio delay is fixed at either 1.33, 2.66 or 5.33 ms from any input to any output of the digital audio network.

CobraNet creates a time-sensitive network for transmitting audio data that can coexist with standard Internet Protocol data networking used for monitoring and control, or for other unregulated data flow on the network.

Compared with other digital audio technologies, CobraNet advantages include:

- Unlike other Ethernet-based digital audio networking technologies, it can coexist with existing Ethernet infrastructure and data traffic (other technologies require their own dedicated network).

- It's a true network that allows audio to be sent from any place on the network to any other place on the network.

- It's a fault tolerant technology – if it senses that one of its lines gets cut, it will automatically switch over to another network path.

- It's Information Technology friendly, using industry standard Simple Network Management Protocol (SNMP) to manage devices on the network.

- It uses the same network for control information, so a dedicated line to send commands to a device on the network is not needed.

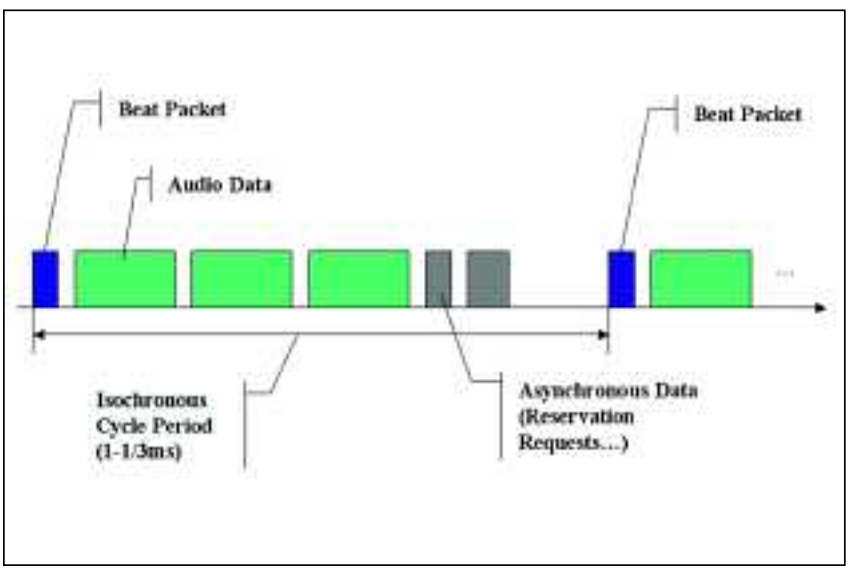
- It has bi-directional audio, control and monitoring functionality.

CobraNet is designed to resolve the inherent weakness of Ethernet for transporting digital audio, making Ethernet viable as the foundation for interoperability among audio devices. Interoperability is the primary goal of industry standards, and CobraNet technology has gained wide acceptance.

This critical requirement for adoption as an industry standard has been achieved, and the first obstacle to broad market adoption of digital audio networking has been resolved.

The Old Paradigm: CobraNet Module + IP License = Design for High-End Products. Because digital audio networking is a superior design strategy and CobraNet is an industry standard for audio networking, then

Different devices, different manufacturers, united under CobraNet.



How isochronous cycle works.

CobraNet Partners

Biamp	Ivie
Bosch	Lab.gruppen
Bose Japan	JBL
BSS Audio	Klark Teknik
Creative Audio	Level Control Systems
Crest Audio	Mackie
Crown	Midas
Clear-Com	Novar
Commentary Systems	Peavey
D & R Electronica	QSC
dbx	Rane
Digigram	Renkus-Heinz
DOD	Richmond Sound Design
DigiTech	RTS
Dynacord	Shure
EAW	Soundcraft
Electro-Voice	Symetrix
Gentner	Telex
Golden Sound	Whirlwind
IED	Yamaha

audio equipment designers must be using CobraNet technology in all of their products. True? Only partially.

Until recently, audio equipment designers have been limited to deploying CobraNet technology into high-end devices, because the per-device cost has been prohibitive to design into lower-tier equipment.

When first introduced, the pricing model included the cost of the CobraNet module, plus an up-front technology-licensing fee, plus a per-channel royalty. Under the old pricing scheme, the more channels in the system, the more it would cost to implement the node.

Not counting the licensing fee, the per-node bill of materials (BOM) for implementing CobraNet technology was around $250. This relatively high BOM cost limited equipment manufacturers from utilizing CobraNet technology in more cost-sensitive products. With this cost structure, CobraNet technology made sense for primary system devices, such as consoles or signal processors, where the CobraNet interface added cost to the product, but an entire segment of mid- and low-tier devices were priced out of the market.

The pricing further inhibited manufacturers from tapping into the lucrative commercial building market where cost sensitivity is prime consideration. In this market segment, CobraNet could be deployed over existing IP networks to add high-quality audio and take full advantage of CobraNet technology's ability to co-exist with data traffic over the Ethernet network.

The New Paradigm: CobraNet + Silicon = Design for Any Venue. Serendipity often spawns some of the best technology ideas. Such was the case when Peak Audio, the developer of CobraNet technology, wanted to re-engineer its modular product into silicon and Cirrus Logic, expert in mixed-signal design for audio systems, wanted to expand its' IC portfolio to address new markets.

The common goal that bonded the two companies was an understanding of the pro audio Original Equipment Manufacturer and end users' needs for

full functionality, design simplicity, low cost and a standards-based approach. By blending core competencies, a new breed of DSP-based CobraNet systems-on-a-chip, the CobraNet CS181xxx Silicon Series IC, was born.

This design integrates most of the CobraNet circuitry into the silicon. On-board components include Universal Asynchronous Receiver Transmitter (UART), Programmable Memory Controller, Static Read Only Memory (SRAM), a 12-channel Direct Memory Access (DMA) engine, a controller for external Voltage Controlled Crystal Oscillator (VCXO), a high-speed parallel host port interface for an optional connection to the product's internal Central Processor Unit (CPU) and a high performance Digital Signal Processor (DSP).

It means that designers can install CobraNet ICs on the motherboard of practically any digital audio device and choose the Ethernet connector that best suits their applications. The reduced size and cost means that CobraNet intelligence can now also be added to new devices, including more consumer-oriented audio equipment, ceiling loudspeakers, intercom systems, power amplifiers and paging systems.

CobraNet networked digital audio processor ICs come in 2 by 2, 8 by 8 and 16 by 16 channel versions supporting 48 kHz or up to 96 kHz sample rates. The chips provide multiple 16-, 20- or 24-bit audio connections across an Ethernet network. Two-way audio control and monitoring is possible from any device on the network.

In conjunction with an external VCXO, the IC delivers a studio-grade, low-jitter clock source, and the chips support single- or dual-Ethernet connections for mission-critical applications.

Future additions to the CobraNet Silicon Series of ICs (see sidebar) will provide additional value through integration. These systems on a chip will feature an optional on-board, programmable 32-bit fixed-point DSP core featuring 100 MIPS of processing power, allowing the designer to add powerful signal-processing features without requiring a separate processor chip.

The most notable aspect of these new digital audio processor ICs is that they come without upfront licensing fees or per-channel royalties. With the new CobraNet Silicon Series ICs, the per-unit BOM for a complete CobraNet implementation has gone from $250 to roughly $25 – a significant reduction. With a dramatically lower BOM, equipment designers can look beyond the higher price point products and cost justify putting CobraNet Silicon Series ICs into much lower-priced equipment.

Under the new paradigm, audio equipment manufacturers can now address new markets with digital audio networking that previously had been out of reach, such as small home-based professional recording studios, smaller live venues and even churches. Commercial buildings, which have the need for both audio and data networking also become a prime customer market for the new low-cost, smaller-form-factor networked devices.

As a result of a "macromutation," digital audio distribution technology has evolved into a fully integrated system-on-a–chip that is streamlining product design, lowering cost and enabling designers to add network intelligence to a host of new products.

The market for commercial networked audio equipment is upwards of $3 billion and growing rapidly, fueled by the ability to build audio systems in which signal processing and amplification components are distributed throughout a facility, be it a live venue, studio or commercial facilities.

Manufacturers of audio equipment are in a strong position to take advantage of this rapidly growing transformation from analog to digital networking. As a result, the time for digital audio is now. ■

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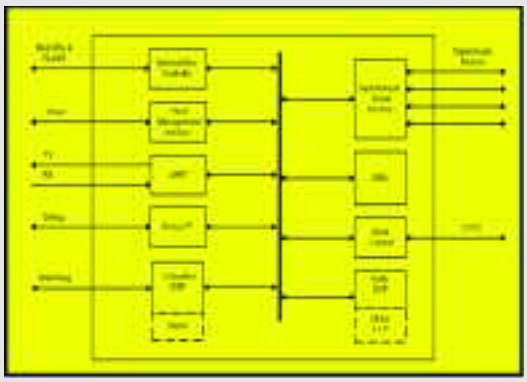
The Latest From Cirrus Logic

At NSCA 2005, Cirrus Logic introduced a new integrated circuit (IC) architecture called the CS496xxx family, which it terms "audio systems processors" because they combine CobraNet technology with CS495xxx dual core, 32-bit audio DSP architecture.



The new ICs are the CS496102, CS496112, and CS496122, differing only by audio in/out channel count (2 by 2, 8 by 8 and 16 by16 respectively). These audio system processor ICs combine a 120-MIPS audio-optimized, 32-bit DSP core along with the CobraNet interface processor on a single chip.

The added DSP power bolsters audio processing capabilities. Quick examples: the ability to include feedback extermination in networked loudspeakers; the inclusion of ambient noise level detecting and noise masking in commercial audio products such as ceiling loudspeakers.

- David Parker, Cirrus Logic