

WHAT'S ALL THIS...

CobraNet Stuff, Anyway?

OVERVIEW

Although CobraNet technology has been used in commercial AV venues for over 15 years, there are always a few new things to know as you consider deploying a CobraNet system. At Attero Tech, we've tried to distill some of the lessons we've learned over the years to put some practical information about CobraNet in this short white paper. We've offered a high-level view of some of the advantages of CobraNet, a short overview of CobraNet and some insight into the signal routing capability of this powerful protocol, and a few words of warning about CobraNet network setup to keep you on the good side of your IT department.

WHAT'S AN A/V PROFESSIONAL TO DO...

There must be a better way

Actually, the problem usually isn't finding a *better way* to do things; new solutions come and go all the time. The struggle is *longevity*: finding a

technology that's proven, fits logically with the needs of your job, and will still be relevant for years into the future.

Take Audio over Ethernet (AoE), for example. There's no shortage of professional equipment that deals in digital audio these days, but most live applications only run digital for ten feet or so before jumping back to analog for distribution. A handful of device-specific formats might vie for the chance to put that signal onto a data network, but the equipment is usually expensive enough that it's not cost-effective to do AoE unless you're wiring up a theme park, stadium, campus, or similarly huge venue.

Well, it's time to take the insanity out of networked digital audio. Start with the [oldest and most widely used AoE standard in the industry](#), add [cost-effective devices](#) that fit in just about every installation (including small venues), and cap it off with [low-cost development tools](#) so that more manufacturers can add the technology to their own equipment.

What does all of that add up to? An easier work day, and fistfuls of cash in your pocket, that's what. It's time you got acquainted with CobraNet, the A/V professionals' best friend.

Okay, but what is CobraNet?

 MATERIALS SAVINGS	 INSTALLATION SAVINGS	 EASY EXPANSION/CHANGE
<ul style="list-style-type: none">• up to 70% less speaker wire• up to 50% fewer connectors• up to 30% less conduit• fewer and less expensive rack-mounted devices	<ul style="list-style-type: none">• less cabling• fewer connectors• less system troubleshooting• simplified system designs	<ul style="list-style-type: none">• expand functionality without running new cable• add components without running new cable• reconfigure without running a room interface

Well, first off, the "cobra" part doesn't have anything to do with snakes. It's a reference to the original Shelby Cobra 289 racer, a GT-class hot-rod that tore up the international race tracks and established American engineering as the last word in muscle cars. What more do you need to know, right?

"A lot more," you say? Ok, well try this on for size: CobraNet is the most established technology for sending real-time, high-quality digital audio over an Ethernet network. With 15 years of installations and support from manufacturers across the industry, CobraNet is the de-facto standard for networked audio in professional A/V. Without boring you with a history lesson on how CobraNet slithered out of the primordial goo, we'll just tell

you that the technology came onto the scene around 1996 and is owned by Cirrus Logic, who develops the core technology and licenses manufacturing rights to major audio industry players like Dolby Labs, BiAmp, Crown, Whirlwind, Yamaha, QSC, and yours truly.

We can get into the nitty-gritty details later, but at its most basic form the CobraNet setup takes a digital audio stream, packs it into a specially-formatted network bundle, and then makes the data instantly available to every other device on the network. Between input and output, there's usually an A/D and D/A conversion, DSP processing, and visits to multiple intermediary devices, too. On a technical level, CobraNet uses OSI level-2 technology to make point-to-point and point-to-multipoint connections between devices. In English, OSI level-2 means that CobraNet acts a lot like a physical cable, but with the important advantage of still being directed as a software signal over the network.

Confused yet? Here's the long and the short of it:

- **CobraNet is high-quality.** There are no codecs involved that throw audio data away in order to trim the sound wave down to a more dainty size.
- **CobraNet is real-time.** There is no packet routing or network congestion that will force you to wait for a buffer to fill before playing.
- **CobraNet is flexible.** There is no hard-wired routing that must be ripped out and reconfigured for you to change where your audio goes.
- **CobraNet is hands-on.** There are design decisions to be made, software connections to configure, and you will have to create an installation that works cohesively.

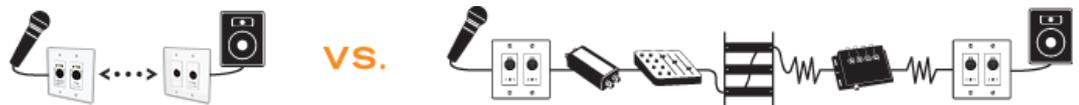
Okay, CobraNet is the best option for AoE. Why do I care??

You'll definitely want to take a look at our list of [eight really good reasons to use CobraNet](#). At the top of the list: you can save a boatload of money on decreased cable, reduced labor and equipment costs, your system becomes much more flexible and extendable, the sound quality is better, installation is a lot less painful, and more and more customers are looking for CobraNet systems integration experts.

Nobody really questions the need for networked audio when talking about super-massive installs, such as theme parks and stadiums, but cost-effective new equipment is making it affordable to use CobraNet, even on mid-sized and small-scale venues. At the very least, it's worth taking a serious look.

Okay, why choose Attero Tech stuff instead of another manufacturer?

Back to the cost-effective devices we referred to a second ago, check out our [Out-of-the-Box A/V product series](#). We've finally made it affordable to get into a CobraNet setup by giving you a way to get digital conversion, DSP processing, and AoE networking right at the wall. It's like taking a 100-foot cable run that goes through mixers, racks, patch bays, switchers, capacitors and amplifiers, and turning it into a four-foot run. It's a night-and-day difference, both in quality and in the decreased overhead. That means money in your pocket.



Still have questions? Take a look at the other resources we've put together on our web site (<http://www.atterotech.com>), including the point-by-point breakdown of [CobraNet advantages](#), the [frequently asked questions](#) section, and the design, tech, and software guides that are downloadable from each of our [product pages](#).

APPENDIX A

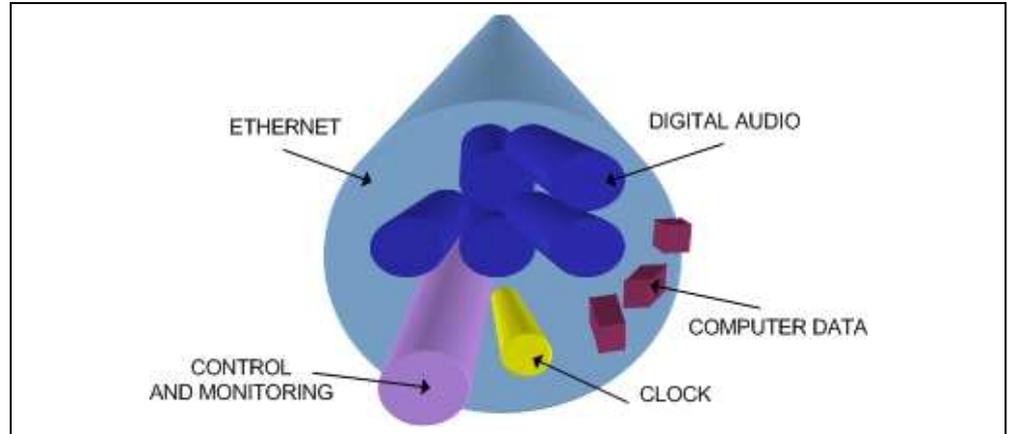
INTRODUCTION TO COBRANET

CobraNet is an audio networking technology for delivery and distribution of real-time, high quality, uncompressed digital audio using a standard Ethernet network. It is implemented using a combination of hardware, firmware, and the CobraNet protocol.

Unlike other audio networking or distribution technologies, CobraNet is a true network and exists on standard Ethernet networks using standard Ethernet hardware. Since it is a true network, audio routing is highly flexible between network nodes and can be used in a variety of audio distribution applications.

In addition to the high degree of routing flexibility that CobraNet provides, the technology also incorporates the ability to monitor and control CobraNet devices remotely. This is a key feature that is highly important in fixed installation applications where the audio distribution equipment may not be readily accessible. All CobraNet devices on the network can be controlled and monitored from a central location by sending control commands and monitoring device specific parameters.

CobraNet provides this capability by implementing Simple Network Management Protocol (SNMP). SNMP is a standard protocol typically used for monitoring network devices such as Ethernet switches. In the case of CobraNet, it allows users to communicate with any CobraNet device using standard SNMP tools or a customized user interface designed specifically for CobraNet, such as Attero Tech's Control Center application.



The figure above represents the types of data that coexist on a CobraNet network.

Before a CobraNet system can be configured, it is important to first understand how CobraNet distributes audio between devices.

Audio is sent in "bundles" on a CobraNet system. Each bundle is capable of holding up to 8 logical audio channels. Every CobraNet device has a number of bundle transmitters and bundle receivers. These transmitters and receivers are the mechanism used to send and receive bundles between devices.

For a transmitted bundle, audio may be sourced either directly from the local audio inputs of the device or from internal audio via the on-board DSP, but not both simultaneously. The internal audio from the onboard DSP could have originally been sourced from the local

device inputs, sent from another CobraNet device or even generated by the DSP itself. Combinations of audio may exist within a bundle in any order. Additionally, a single audio source in a device may be used multiple times in a single transmitter bundle or across multiple transmitter bundles.

For a received bundle, the received network audio may be routed directly to the device's local outputs, the internal DSP¹ or simply ignored.

Once the contents of a bundle have been decided, the next step is to pass the bundle to another CobraNet device. To do this, every CobraNet device has up to 4 bundle transmitters. Each bundle transmitter has a transmit mode that must first be selected. This affects how many devices may receive that particular bundle at a time.

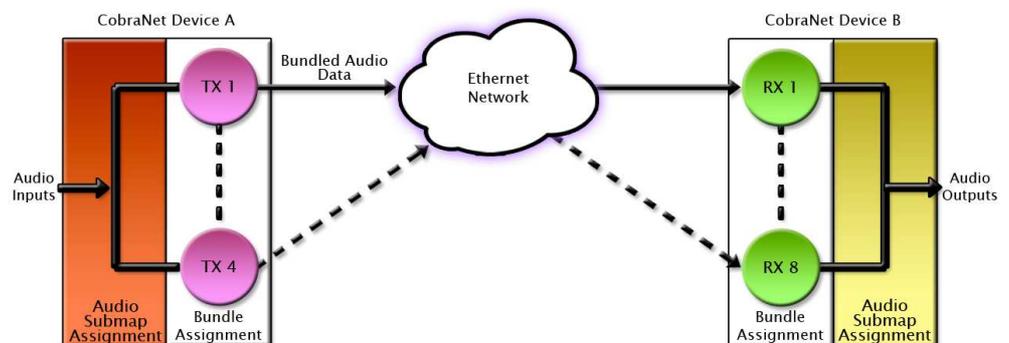
The modes are as follows:

- **Unicast** – Used for one-to-one connections. In this mode, only one receiver at a time can receive this bundle. Once a link is established from this transmitted bundle to a receiver, any future requests for that bundle from other potential receivers will fail.
- **Multicast** – Used for one-to-many connections. This mode broadcasts its contents over the entire network. There is no restriction on the number of receivers. However, the downside is that CobraNet packets are distributed to all nodes on the network, whether they need them or not thus creating possible network bandwidth issues.
- **Multi-unicasts** – Another one-to-many mode. Whilst this is the most efficient method for getting a bundle to multiple receivers in terms of network bandwidth, it requires more processing power on the CobraNet device so in this mode there is a maximum limit of four receiver connections (this can be reduced if required). If more connections are required than the limit, the node can be configured to automatically switches to multicast.

Once the mode is selected, to enable a device to transmit the bundle, simply allocate the particular transmitter bundle a non-zero number. Since this number identifies all the network packets sent out by that transmitter, each transmit bundle number must be unique on a network.²

NOTE

When a bundle must be transmitted to multiple receivers, multi-unicast transmissions should be used where possible.



¹ Not available on all devices – CS496xxx devices only

² Bundle numbers range from 1 through 65535. A value of 0 represents an inactive bundle. Numbers 1-255 are reserved for multicast mode transmissions only.

Now that the transmitter is set up, it is time to set up the receivers. In order to receive bundles, each CobraNet device has up to eight bundle receivers. To enable a device to receive a bundle, simply allocate one of that device's bundle receivers the same bundle number as a transmitted bundle. By doing so, a virtual link is created and audio should now be passed from one device to the other. It should be noted that no knowledge of a device's network topology or connection is thus required in order to configure audio connections. The only restriction to this is that a device cannot be set up to receive a bundle it is also transmitting.

The above case creates a simple, one-to-one, unidirectional link. If more devices are required to receive that bundle, allocate the same transmitted bundle number to a bundle receiver on the other CobraNet devices.

It is also important to note that CobraNet supports simultaneous bidirectional audio distribution in each device. Not only could audio be sent from Device A to Device B but at the same time, should it be needed, audio could also be sent from Device B to Device A. The exact bundle and routing configuration will be determined by the needs of each individual installation. An installation may have multiple units transmitting multiple bundles. The only restriction is the bandwidth available on the network to transfer the audio.

CobraNet does more than just transfer audio/video data. It can be used to pass serial information as well. A feature called serial bridging has been incorporated that allows the passage of serial data between nodes. Each node can pass serial data to a specific node or multicast the data to multiple nodes. A node can also receive data from either a single source or multiple sources. Baud rates, data bits, stop bits, parity, and so on are all configurable. There is also support for multi-drop serial buses as well.

Finally, CobraNet has the capability to alter all of the above options in real time making the whole system completely dynamic. By use of control software, all of the bundle assignment parameters can be configured with no need to change cables, switch out connectors, or pull new wiring. Most importantly, this control capability can be implemented from a single location!

APPENDIX B

COBRANET & PC NETWORKS

Whilst CobraNet is compatible and can co-exist with standard Ethernet traffic from PCs using the same infrastructure, it isn't all plain sailing. On lightly used systems, it is likely there will not be any noticeable problems. However, as audio/video system usage increases and/or PC network traffic increases, network bandwidth quickly disappears. Eventually, there becomes a point where PC operations over the network, such as web access, will begin to slow as CobraNet data is given priority. Fortunately, such problems can be overcome.

Physically separating the networks into two separate pieces, one for CobraNet traffic, the other for normal network traffic, is the ideal solution. This is often the way practical systems are implemented, since the A/V installer has little control over the typical home LAN. Having a separate A/V cabling infrastructure is the best way to prevent nuisance callbacks, and guarantee that changes on the home LAN do not affect the A/V system.

A slightly different approach uses network devices that can separate the traffic internally by implementing virtual networks. These virtual networks ensure that the PC traffic and CobraNet traffic cannot interfere with each other and are kept completely separate even though they are travelling through the same network device. The down side is that Ethernet switches with this capability are more expensive than standard switches.

Separating the audio system from the PC network gives best performance, but what if one or more of our A/V sources is PC or internet based such as internet radio, and needs access to the PC network? Homes aren't likely to want or have a dedicated PC or a dedicated internet connection just for the audio system. In such cases, a bridging device will be needed that prevents CobraNet data getting onto the home LAN while permitting the A/V device full home LAN access. Such a device could be a standalone device or the functionality could be built into an endpoint at very little cost.

ABOUT ATTERO TECH

Attero Tech is a leading provider of CobraNet® audio interfaces. These products make it easy and cost effective to integrate a wide variety of audio components such as consumer electronics, microphones, paging speakers, computers, and recording devices into a networked audio system. Attero Tech solutions help AV systems integrators reduce cost, improve audio quality, future proof systems, and meet their most unique design requirements.

Attero Tech is headquartered in Fort Wayne, Indiana. For more information on Attero Tech's full line of products, please visit www.atterotech.com.

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