8 REASONS …

…you should be using CobraNet

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 identified some very practical and cost saving reasons for using 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.

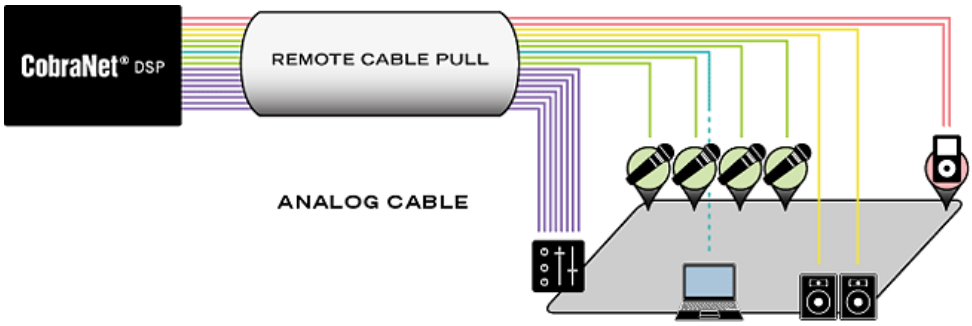
AND NOW, THE 8 REASONS…

Reason #1 - Fewer cables to run

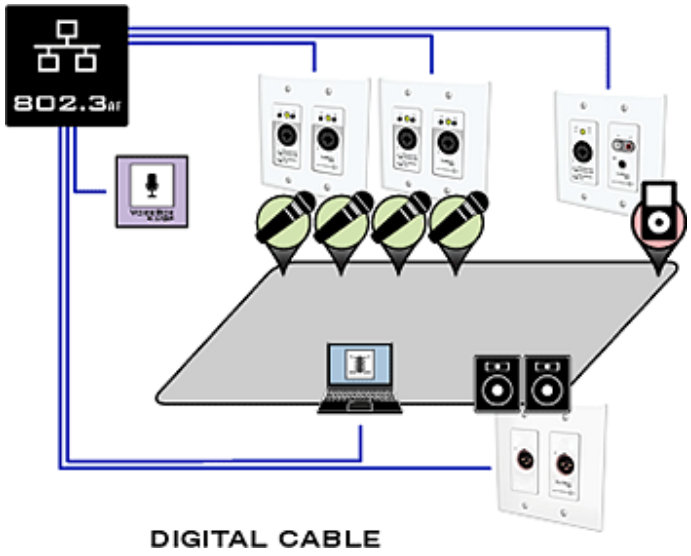
No matter how you do the math, running analog cable is expensive and error prone. Carefully plan around existing utility structures and architectural hurdles, but don't run too far out of the way or you'll start bumping up

WHITE PAPER

against voltage drop issues. Factor in conduit (you'll probably need it on every line), and solder on a couple of connectors on the end of the line. Oh, and don't forget, you'll want that powered speaker to actually turn on, so go ahead and throw down a 120VAC run somewhere nearby. If you're lucky, you won't need a signal repeater, ground-loop killer, or patch bay. Got it? Great, now do it all over again for *every single channel in your system*.



Wait, why did you just start crying?



Let's drop all of that foolishness and just replace the analog cable with much less expensive CAT-5 UTP. CobraNet's digitized structure lets you send up to **64 channels** over just one networking cable. And all of that power conditioning equipment? You don't need it, since digital audio bundles aren't susceptible to ground loops or interference, and you can spool a line longer than a football field before it runs out of signal strength. Say goodbye to the soldering iron and metal connectors, you'll be trading them for easier-to-install plastic RJ-45 clips and a crimping tool. Heck, some CobraNet equipment even comes PoE-equipped, meaning that you can feed them power over the Ethernet cable and leave out the wiring of a new power outlet.

Reason #2 - Less analog = better sound quality

Analog sound suffers on every step of its journey: every termination is a chance for a faulty electrical connection or ground loop issue, every power source can couple hum and noise, every foot of cable contributes to attenuation, and every step of the way is a chance for someone to come along and physically damage the set-up.

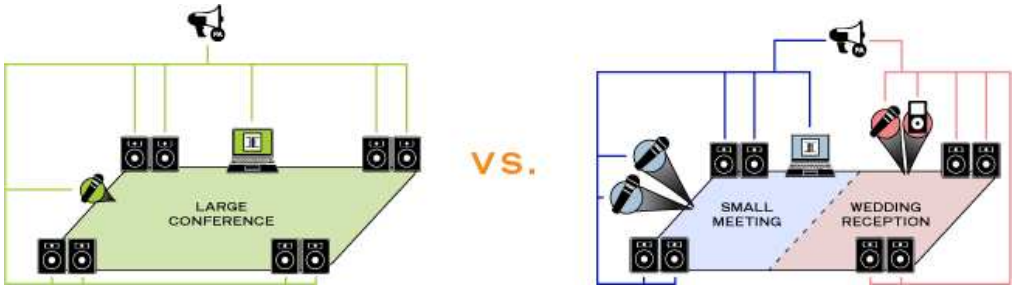
On the other hand, your sound is pretty much bulletproof once you convert it to digital. Ones and zeros just don't have the susceptibility to the kinds of signal interruptions that plague analog. You don't even have to use shielded cable, and you can go through many connections without introducing noise. Now that you can install CobraNet right at the wall, you can turn what used to be a 100-foot analog run with ten or so chances to degrade your signal into a four foot run with just one connection on each end.

Come to think of it, your CobraNet transmission can actually sound better than the original. After all, we've already got a digital signal in the box, so why not apply some digital signal processing? In a fraction of a second, our InBoxes run a quartet of audio improvements – configurable compressor, EQ, gain and delay – then send it on to the CobraNet cloud.

Reason #3 - Reconfigure the layout with the click of a mouse

CobraNet lets you disconnect, reconnect, route, reroute, P.A., intercom, private line or party line, connecting every single device in your design, all without touching a single cable. Try doing *that* with analog.

Every CobraNet device is connected to send/receive a signal from every other networked device, and it's all configurable by running software on the LAN. Imagine a hotel ballroom that converts from a split meeting room/dining room, into a large conference hall, all with the push of a touchscreen or a command from a remote control room.



Reason #4 - Less (and easier) troubleshooting

Has something like this ever happened to you? You're wiring up a P.A. system in an elementary school, and the speaker in room 207 refuses to squawk when you send a signal from the receptionist desk. Room 193 is intermittent, and there's a slight hum in the auditorium. Faulty connector? Voltage drop? Wiring mistake? Busted circuit in the switch? Missed connection on the patch bay? Defective cable? Looks like you've got some detective work to do, and your problem rooms are on opposite sides of the building. Oh goodie.

This just doesn't happen in networked audio. Run the CAT-5, plug it in, and if it turns on then move on to setting up the software—you're done with the install.

Reason #5 - Add a new line, there's nothin' to it!

Client: "We need to add a single mic line to our fifteen-room sound setup."
You: "Yeah? Well, I'd like a solid-gold Harley with machine guns on the front, but I don't think *that's* gonna happen either, buddy."

Such a simple request, but it's a one way ticket to cable-pulling, patch-bay-rat's-nest-making, interference-inducing hell.

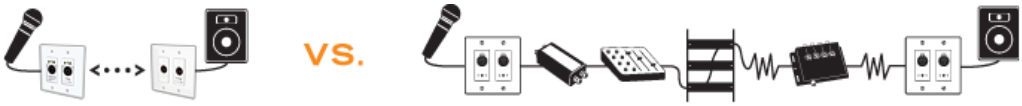
That is, unless you're using CobraNet. With CobraNet, you'd just run some CAT-5 from the switch (or cannibalize an existing data line), plug in a PoE, network-at-the-wall box, configure the software, and you're done. That was easy.

Reason #6 - Equipment made obsolete

Distribution is a huge side of the digital equation, but it's not the only one. A CobraNet-ready signal is just begging for some DSP lovin', and who are we to argue with fate? Send the signal on to a networked rack for some big-iron processing, or run it through some simple conditioning in the original box; either way, you have every opportunity to send some expensive analog equipment to the scrap pile.

At the very least, you'll eliminate a ton of cable, soldered connectors, and there won't be any need for isolation transformers or distribution amps. With the advanced DSP in our InBox series, you now have access to a built-in compressor, equalizer, gain and delay. The heavy-hitting VoiceBox 4I/OP features a superior DSP that lets it serve as a cost-effective mic/line preamp, mixing console, matrix mixer, or a supplemental processor to aid the big iron on your network. And, every Attero Tech device can process up to 8 signals

at a time, whether they're from physically plugged-in cables or are a networked audio bundle.



Besides saving a ton of cash by eliminating the cable, labor and external processing equipment, there's a direct client benefit to using CobraNet devices, too. Whether it's a wall-mounted junction box or a mini-rack format processor, you're also eliminating big, bulky boxes that are in constant danger of getting damaged, stolen, or reconfigured by a sticky-handed 8-year-old named Timmy. For small venues, those DSPs give them access to features that they'd otherwise just learn to live without.

Reason #7 - Shift installation to the grunts

Did a three-year-old just try and find out if she could cram a whole peanut-butter & jelly sandwich into one of your XLR jacks? No need for a service call. Just send the client a new box, reloaded with your saved configuration, and it's Miller Time.

On the install front, why not have the IT guys or an electrician do your cable runs, too? Now that you're using CAT-5, you can rest easy having someone else do your bidding, without fear of them introducing analog headaches for you to troubleshoot. Nice!!

Reason #8 - Welcome to the 21st Century

Right now, the only thing that has really kept digitally networked audio from completely immolating the analog world is the cost and availability of equipment. Those final barriers are finally starting to erode, and we're doing everything we can to fuel the audio over Ethernet revolution.

More and more clients are requesting networked audio like CobraNet, not because they know exactly what's out there, but just because they figure that everything else can live on a network, so *something* like this just *has to* exist. Make sure that you are the one to play matchmaker. CobraNet audio installers can save a ton on installations, offer flexibility and expandability to their clients, and are finding that demand for their networking know-how is continually growing...

APPENDIX A

INTRODUCTION TO COBRANET

NOTE

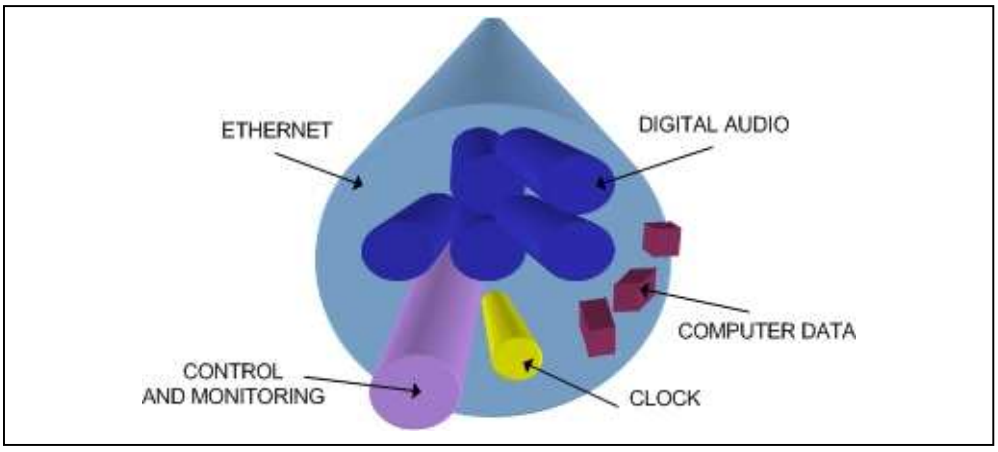
Appendix A explains some of the terminology and concepts that underlie CobraNet technology.

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 DSP[1] 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.

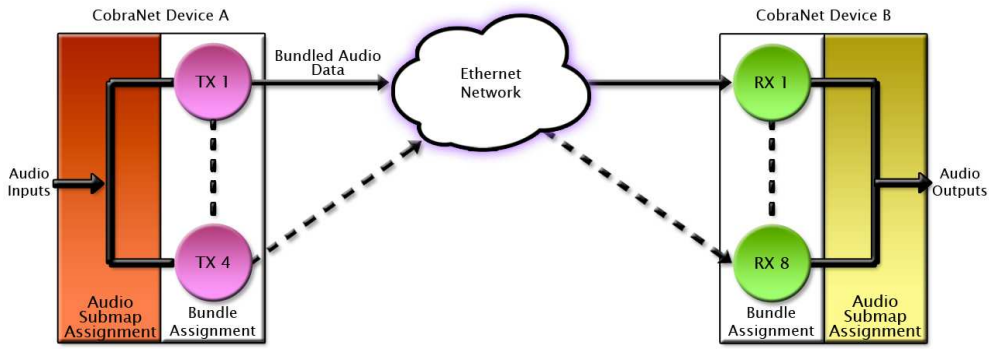
The modes are as follows:

- **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.