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CobraNet Primer

General

CobraNet is a licensed technology developed by Peak Audio, Inc. consisting of proprietary communications protocol, firmware and hardware. It allows reliable, deterministic (i.e. real-time) transmission of high quality (i.e. un-compressed) digital audio over standard 100Base-T Fast-Ethernet network. CobraNet will also operate on faster versions of Ethernet (e.g. Giga-bit and 10Giga-bit).

A CobraNet system is comprised of CobraNet devices and the Ethernet network that connects them. PCs or other system controllers may also be connected to the network for setup but are not required for operation.

Ethernet

Ethernet is a hardware and signaling specification developed by Xerox in 1970 for data networking. The IEEE (Institute of Electrical and Electronics Engineers) standardized the technology in the IEEE 802.3 standard and its variants.

With over 50 million nodes installed, Ethernet is easily the most dominant data networking technology in use today. It is carried over inexpensive CAT-5 UTP cables or fiber. Continued growth is expected for 100MB Fast-Ethernet, Giga-bit Ethernet and even 10Giga-bit Ethernet.

Typical Ethernet cabling limitations are: 100 meters over CAT-5 copper cable, 2 kilometers over multimode fiber.

See also: [Ethernet Overview \(Peak\)](#)

The CobraNet Device

Each CobraNet device embeds specialized hardware and firmware. The hardware includes a standard 100MB Fast-Ethernet interface along with custom high-speed DSP chips and clock circuitry. The DSP and its embedded software are used to encode and decode the Ethernet network messages using the proprietary protocol. The clock circuitry is used to accurately decode the system master clock timing needed for high-quality real-time audio delivery.

Audio Specs

All CobraNet devices operate at a fixed sample rate of 48kHz. The audio data may be transmitted at 16, 20 or 24 bit data as desired. For reliable operation, each CobraNet device must implement transmit and receive buffering. This buffering is fixed at 256 samples and results in a minimum audio network latency of 5.333ms. (256 samples at 1/48kHz per sample)

Bundles and Audio Channels

Routing of digital audio between CobraNet devices is accomplished through Bundles. A Bundle is the name given to the proprietary encoded message (a.k.a. "packet") transmitted between CobraNet devices that include multiple channels of digital audio. Each CobraNet device can transmit and receive up to four Bundles. Each Bundle includes up to 8 Audio Channels. Therefore, each device is capable of transmitting and receiving up to 32 Audio Channels to and from the network.

Bundles can be transmitted using Ethernet multicast or Ethernet unicast methods. Multicast Bundles are sent to all CobraNet devices on the network, while unicast Bundles are sent to one and only one CobraNet device. Since each device can send and receive four Bundles, great flexibility is allowed in the routing of audio over the network. Up to 8 multicast Bundles (64 Audio Channels) can be transmitted on a simple repeater based Ethernet network. Up to 4 multicast Bundles (32 Audio Channels) along with up to 421 unicast Bundles (>3000 Audio Channels) can be transmitted simultaneously on a full-duplex switch-based CobraNet network.

Assignment of Bundles is accomplished through the selection of a Bundle number. Bundles between 1-255 are always multicast, while Bundles between 256 - 65,279 are unicast. Bundle assignments must not be duplicated. Only one CobraNet transmitter is allowed per bundle

See also: [Bundle Assignments in CobraNet Systems \(Peak\)](#)

The Conductor

On a CobraNet network, the Conductor coordinates transmission of audio packets throughout the entire network. When two or more CobraNet devices are interconnected properly, one of them will be selected the Conductor based on their respective Conductor Priority. A higher Conductor Priority over-rides a lower priority. If an operating Conductor is removed from the network for any reason (e.g. power turned off), the remaining devices again arbitrate and select a new Conductor. All CobraNet devices have the capacity to serve as the Conductor.

The Conductor periodically broadcasts a well-defined message to all CobraNet devices. This allows each CobraNet device to recover the master clock timing information needed for high quality audio delivery.

The Conductor also recognizes each CobraNet device on the network and assumes the responsibility to assign transmitter positions and priorities for each Bundle of each CobraNet device. Like a conductor of an orchestra, the Conductor signals the beginning of a synchronous transmission cycle, and then each device sends its Bundle(s) in lock step.

Primary and Secondary Network Ports (Dualink)

Some CobraNet devices implement two network connections. This provides for added reliability in the event of problems with network hardware or cabling. If the primary connection is lost, the secondary connection can be enabled using an entirely separate network hardware path in less than a few seconds.

Repeater Networks

CobraNet can operate on simple repeater-based networks and more complex switch-based networks. Repeater networks use low-cost Ethernet hubs. On a repeater-based network, all packets are broadcast to all connected nodes. CobraNet multi-cast and unicast Bundles can be assigned but because of the simpler repeater-type hubs, even unicast transmissions are broadcast to all nodes. Therefore, a maximum of 8 full-loaded Bundles (64 audio channels) are allowed on the entire network. More Bundles may be allowed if they are loaded with less than the full eight audio channels. There is no limit to the number of active receivers on a repeater network. Generally, a repeater based CobraNet network must be dedicated to CobraNet traffic only to guarantee reliable transmission of audio packets.

See [Tested Ethernet Products](#) on the Peak Audio website for a list of recommended Ethernet repeaters.

Switched Networks

Larger CobraNet networks can be built using Ethernet switches. Ethernet switching technology is more sophisticated than hubs. Switches do not simply broadcast each and

every packet to all nodes. Instead, they examine the destination address of each packet received on each port, and then “switch” that data to the identified recipient. CobraNet unicast Bundles exploit this feature to allow more overall network traffic. In effect each port has 100MB of bandwidth and the overall network can be as large as 100MB times the number of ports on the network. Multicast Bundles are allowed on a switched network, but they must be used with care. Peak recommends that not more than four multicast Bundles be used in a switched CobraNet network.

Another enhancement available with most new Ethernet switches is “full-duplex” links. A full-duplex link allows simultaneous send and receive over the same Ethernet connection. This enables a CobraNet device to simultaneously send and receive up to 64 channels per node for a total of 128 channels.

The combination of switching and full-duplex technologies in switched CobraNet networks allows up to 128 channels per 100Mbit Ethernet link and greater than 3000 individual audio channels. There is no limit to the number of active receivers on a switched CobraNet network.

Switched networks also eliminate the potential for Ethernet collisions. This allows general PC network traffic and CobraNet traffic to coexist on the same network.

See [Tested Ethernet Products](#) on the Peak Audio website for a list of recommended Ethernet switches.

CobraCad Software

CobraCAD™ is a new software tool that provides a simple graphic user interface for the design, configuration and monitoring of CobraNet networks. There are also other Ethernet network design and diagnostic software applications available.