ABA Engineering Academy Continuing Educational Series: Understanding Network Protocols

As broadcast operations continue to migrate toward audio and video over IP, one thing stands out. The Engineer must make a choice of what type of transmission protocol to use or most times the equipment manufacture does it for you.

A network **protocol** defines rules and conventions for communication between network devices. Network **protocols** include mechanisms for devices to identify and make connections with each other, as well as formatting rules that specify how data is packaged into messages sent and received.

As networking speed and reliability have increased, and the underlying technology has become more affordable, transporting audio/video over an Ethernet cable now offers dramatic savings of time and money, making it more attractive than ever.

Over the years one of the major cost factors in developing new equipment was the research and development. When using IP as a transport system, broadcast equipment designers can take advantage of the research and development done by the major players in the IT world. Broadcast systems just package the payload into a standard IP package using the correct protocol.

There are several different protocols in the market place, some are vendor specific while others work to allow different protocols to communicate together.

In this article we want to look at AVB (Audio Video Bridging). This is an extension to the Ethernet standard designed to provide guaranteed quality of service, which simply means that audio samples will reach their destinations on time. AVB allows you to create a single network for audio, video, and other data like control information, using an AVB-compatible switch. This enables you to mix normal network data and audio network data on the same network, making it easier to create both simple and complex networks. Numerous audio companies have adopted it, and more companies are adding it all the time.

AVB networking offers several features that make it ideal for audio applications:

- **Long, light cable runs.** A single lightweight CAT5e or CAT6 cable can be run up to 100 meters (328 feet). This makes it easy to have audio I/O located in different rooms (or even different venues in the same building) and run multichannel audio between them in real time.
- **Low, predictable latency.** AVB provides latency of no longer than 2 ms sending an audio stream point-to-point over up to seven "hops" (trips through

switches or other devices) on a 100 Mbps network. With higher speed networks, many AVB devices support lower latencies and additional hops.

- **Scalable, with high channel counts.** AVB's bandwidth is sufficient to carry hundreds of real-time channels using a single Ethernet cable. This offers the future possibility of expanding your system with additional devices that contain different kinds of audio I/O, multiple controllers, and other useful functions.
- **Guaranteed bandwidth.** AVB networks intelligently manage the data traffic giving priority to AVB data. This means standard network traffic, such as Internet streaming, won't prevent your audio from being delivered reliably and on time.
- **Integrated clock signal.** In a digital audio system with multiple devices, having a master clock is critical to maintaining audio fidelity. The AVB specification defines such a clock to be accurately distributed to all devices in the system.

What makes AVB ideal for audio networking is that it splits network traffic into real-time traffic and everything else. All real-time traffic is transmitted on an 8 kHz pulse. Anything that's not real-time traffic is then transmitted around that pulse. Every 125 µs, all real-time streams send their data. Other packets are transmitted when there is no more real-time data ready to be transmitted. To make sure that there is enough bandwidth available for all prioritized real-time traffic, the Stream Reservation Protocol (SRP, IEEE 802.1Qat) is used.

AVB devices stay in sync by selecting the best master PTP (Precision Time Protocol) clock after the devices connect with one another. This ensures that every AVB device on the network will maintain precise timing, which is critical to audio quality.

SRP works with the 802.1Qav Queuing and Forwarding Protocol (Qav) to ensure that once bandwidth is reserved for an AVB stream, it is locked down from end to end. Qav schedule time-sensitive streaming information to minimize latency. Together, SRP and Qav make sure that all reserved media streams are delivered on time.

AVB networks require the use of either CAT5e or CAT6 cables, both of which support Gigabit speeds at lengths up to 100 meters. CAT6 is designed to support speeds up to 10 Gb/s (10GBASE-T or 10 Gigabit Ethernet), but it is backward compatible with CAT5e.

The primary differences between CAT5e and CAT6 cable are the wire gauge of the conductors and the number of twists per inch in each wire pair. CAT6 cable uses heavier gauge wire and more twists per inch, providing lower crosstalk, higher signal-to-noise ratio, and an overall better performance rating than the CAT5e equivalent.

Before you plan a new studio build out, check with the equipment manufacture about using the AVB protocol. A good number have plug in cards for the various protocols available.

Thanks to Presonus learning series for information in this article. We look forward to your comments and suggestions about our Continuing Educational Series.

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