"If and when the auto industry gets behind AVB, then the demand for AVB-compatible hardware will go up, the economies of scale will kick in and the cost of the hardware will drop, making it more accessible and affordable for the pro audio and video industry."

Technology Focus by Richard Cadena

This month: Is Audio Video Bridging the Next Big Thing?

A good data network can seem like magic when it works, but when it doesn't it's more like a guy in a top hat with the zipper down on his trousers. If you've ever streamed audio or video on a network then you've likely experienced delays or jittering because of data buffering or because your computer is low on resources. If you're listening to music or watching a movie for your own entertainment, that can be annoying. But if you're supplying music or video for a live event, it can cost you your job or a client.

GO NOW!

As a live event professional, when you hit the Go button, you can't afford delays or inconsistent results. The problem is, the architecture of the average network isn't designed to be reliable first and foremost; they're designed to work as best they can, given the available resources. Yet networking is the way to go when it comes to maximizing efficiency and lowering costs. It's much more logical and economical to use a single Cat5 or Cat6 cable to send multiple channels of audio and/or video instead of using a fat snake with dedicated analogue audio signals. Plus, digital signals, when they are done properly, are clean signals with a higher signal-to-noise ratio than analogue.

There are a variety of protocols used to transport audio signals, and that's generally the way it's done these days. Most of these competing protocols work in a similar fashion except they are not interoperable, meaning they can't talk to one another, because they all do things slightly different. They might have different rates of transmission, different ways of packaging the data, etc. But they are similar in that they use proven networking hardware, techniques, and technologies.

Most data networks are packet-switched, meaning they send data in packets rather than in a continuous, unbroken stream. The data is broken up and packaged into byte-sized chunks and wrapped in a virtual wrapper before they are sent across the network to their destination. They are usually sent in regular intervals but when they arrive is anybody's guess. It depends on the route each packet takes through the network and how much time each device along the way uses to process the packet (latency).

And when the packets do arrive, there is no guarantee they will arrive in the same order they were sent. It's up to the network to make sure the individual packets are reassembled in the correct order, and that doesn't always happen in real life as it was designed on the chalkboard. In fact, there's no guarantee those packets will arrive at their destination at all. If they get lost or get corrupted along the way, oh well, please try again. In the world of live event production you may get fired before you are able to try again.

So how do we in the live event production industry stream audio and video data reliably?

BRIDGING FROM A TO V

That's the question that the Institute of Electrical and Electronic Engineers (IEEE) starting asking around 2004. What started as a project to reliably stream audio and video for home theatre became something much more ambitious for the auto industry, consumer electronics, and professional AV. Audio Video Bridging (AVB) emerged as an IEEE standard designed to deliver the reliability that is missing from conventional networks.

AVB allows audio and video to be streamed reliably by insuring synchronisation between different signals or streams like audio and video, and by controlling the way traffic flows through a network. The way it does it is very similar to the way most networks work, except it has built-in reliability, which allows for the use of non-AVB devices on an AVB network, and the components can talk to one another.

In an AV network, timing is everything. To make sure everything on the network is synch'ed properly, the AVB network uses IEEE 802.1AS, which in turn uses parts of IEEE 1588 Precision Time Protocol (PTP), a protocol that is normally used in industrial controls, testing and measurement, providing clock accuracy to less than one-millionth of a second. If that seems extreme, it is, considering that sound travels about 340 metres per second at sea level. So in one microsecond, which is one-millionth of a second, sound travels about 0.34 millimetres. It also has partial support for wireless, power line carrier technology, and coax cable.

An AVB system uses one device for the master timing signal, which is called the grandmaster, and all other devices on the network can synch' to it. The grandmaster can be assigned manually if need be, which is often the case when synching audio to a MIDI time stripe or genlocking video.

SHIP SHAPE TRAFFIC

AVB also uses another protocol, IEEE 802.1Qav, to make sure that the packets are delivered at evenly spaced intervals rather than all at once. If the packets bunch up and try to get through the network at the same time, they take up a lot of the bandwidth and available

resources, which can cause the network to slow down. So AVB makes sure the packets are doled out evenly, which is called “traffic shaping.” There are lots of rules about traffic shaping but basically, AVB traffic takes priority over everything else so that the data can be streamed smoothy and reliably.

There is yet another protocol used in AVB that makes sure the network has the resources available to make the magic happen. In effect, it reserves the available resources it needs to do the job properly with a protocol called 802.1Qat Stream Reservation Protocol (SRP). How much bandwidth it reserves depends on the requirements of the content, which is categorised by class and data rate. If the network has sufficient bandwidth and resources, a specific path is locked down to insure the streaming data can make it to its destination undeterred.

All of these elements combine to deliver a data stream from a source to one or many receivers on a network. The protocol was recently demonstrated at InfoComm in Las Vegas last June and at ISE in Amsterdam last January in the AVnu Alliance Pavilion. AVnu is an organisation that was created to promote the adoption of AVB and to work out the kinks in the newly developed and developing protocols. Their work includes creating compliance tests designed to make sure that when manufacturers implement AVB, the result is that the product works with all other AVB-compliant devices, or what is known as interoperability. Their membership is made up of 44 manufacturers, from Analog Devices to Yamaha. AVnu has been hosting a series of Plugfests where manufacturers can test and debug their implementations as well as network with and compare notes with other manufacturers.

When the AVnu Alliance called a press conference and pressed the play button on the MP3 player -surprise! - music streamed through the amplifier and speakers on the other side of the pavilion. To the casual observer it may have seemed uneventful but to the trained mind, it was. And that’s precisely what was intended to happen - nothing out of the ordinary except that the content was streaming across a network directly to a variety of devices made by a variety of manufacturers and it never jittered or buffered. The stream of music was sent from FOH through the network to all of the connected equipment displayed in the pavilion. Then someone at the Riedel station spoke into a microphone and his voice came out of the same amplifier and speakers across the pavilion to demonstrate the bi-directional communications capability of the network and how each node can send or receive data.

FAST FORWARD

Will AVB become the dominant networking protocol in the AV industry? The key to the success of AVB will be the uptake by manufacturers of the standard. Several manufacturers at InfoComm, including Audinate, Riedel, Crown, Biamp, dbx, and more have already implemented it. It appears to be picking up momentum.

Meanwhile, Audinate has been busy moving forward with Dante, a proprietary protocol they developed for streaming AV data, much like AVB with some exceptions. In addition to guaranteeing low latency, Dante provides more bells and whistles than AVB, like the virtual sound card that allows you to record in real time, redundant data transmission, and auto discovery of Dante devices on the network. Dante can also use AVB, so devices with the Dante protocol can take advantage of either protocol. Dante works with PCs or Macs, and it works with any network switch, while AVB requires an AVB switch.

Dante is versatile. It can support a variety of sample rates as well as multicast or unicast transmission. Casting is important for maintaining low volumes of data traffic, which in turn makes the best use of bandwidth. If everything on the network is broadcast, then the data becomes multiplied at each node and that can choke a network. Audinate claims that over 50 manufacturers have adopted Dante and integrated it into their products.

But the question remains, what is the future of audio and video networking? Will the industry embrace AVB or will proprietary standards like Dante surpass it?

COMPETING PROTOCOLS

Technology moves very quickly these days, but economics still dictates how quickly the market adapts and uses standards. Cobranet has been around since 1995 and there are myriad Cobranet products in the field that aren't going away simply because there are new and better standards. But AVB is likely to get a strong foothold in the auto industry because of its potential to replace a large number of individual copper wires with just a few wires. That would lower manufacturing costs, make troubleshooting and repair quicker and easier (provided you have the right tools), and make the vehicle more lightweight and thus more energy efficient. If and when the auto industry gets behind AVB, then the demand for AVB-compatible hardware will go up, the economies of scale will kick in and the cost of the hardware will drop, making it more accessible and affordable for the pro audio and video industry.

Lee Minich, spokesman for AVnu Alliance. (photo: PLASA Media)

But consensus standards like AVB can be slow to develop and adapt to the changing times, whereas proprietary standards are unencumbered by the process of making everyone happy about the details of the standard. As a result, they are usually much lighter of foot and faster to develop and implement. But there is room in the market for both because people want choices and they want simplicity.

In addition to AVB and Dante, there are likely to be other new, open source standards that come along as long as people across the world can connect on the internet and computers keep getting more powerful. Lots of people love working with open source standards for the satisfaction of contributing to technology, raising their profile in the industry, or perhaps for their own glorification. Whatever the reason, the dynamics of individuals coming together on a temporary, often fleeting basis, creating fluid, responsive code to solve specific problems is often like the murmurations of starlings (**http://youtu.be/eakKfY5aHmY**). It changes, adapts, moves to the left, then to the right, all very quickly and fluidly. You never know what the result might be but it's usually startling and beautiful.

Technology is changing faster than it has ever been, and its increasing complexity means that standards makers have a bigger challenge than ever before. A lot of people have put a lot of time, energy, and resources into AVB and Dante, and they are both likely to gain ground and be around for a while. But who knows what the next murmuration of the starlings will bring?

AVnu Alliance: www.avnu.org
Audinate: www.audinate.com