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Linking up

Roland Hemming, May 26, 2011

As with almost every other technology it seems, audio components are now being networked. Roland Hemming explains how to achieve nirvana.

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We've been using digital audio for years and many devices contain some form of digital connection, from microphones through to networked self-powered loudspeakers. We are also used to being able to connect high-quality, uncompressed audio from one device to another.

However audio networks – where sometimes hundreds of audio channels can be routed freely around a building according to changing needs – have been slower to develop.

Networks allow you to connect many audio devices together using Cat5 or fibre over an IP-based or proprietary network. Whilst networks have been around for about 18 years, they are still only used on around five per cent of all sound systems. But this is changing quickly.

An audio network can link rooms together, split any signal and route it anywhere in your building, remotely control or monitor any element of your system from any location and send many channels of audio large distances without loss of quality. In short, you can change what

your sound system does whenever you want. All this is done using a low cost infrastructure, industry standard protocols and with a choice of compatible equipment from a number of manufacturers.

The variety of audio equipment that can be networked is increasing all the time. In the beginning it was only networked signal processors. Amplifiers arrived next followed by loudspeakers and mixers. Some devices boast network ports as standard; others let you add this facility with a slot-in card.

All network protocols were designed specifically to make sure better-than-CD quality, multi-channel audio could be networked, some over standard Ethernet – as realtime (well nearly realtime), uncompressed audio. This is important, the network is completely transparent. You won't lose any audio quality across the network, unlike video conferencing technology where the audio (and video) is compressed and reduces in quality to cope with the bandwidth available.

Standards

Whilst the facilities and reliability of audio networks are well established, they lack a standard. In fact several 'industry standard' audio networks exist alongside a number of the manufacturer-specific. Some are IP-based; others are not. But the most important thing to know is that they are all incompatible with each other. Once you have chosen one network, you can only specify products that can accommodate that network port.

Some manufacturers offer their products with different network options, so you have to make sure you order the correct model or slot-in card.
Each network available has its own advantages and disadvantages. Some let you run over standard IP networks. Others exhibit very low audio latency and are cheaper. Yet others let you send hundreds of channels down the one cable. There is no 'best' answer.

One of the most commonly asked questions is: "Can I run my audio network over an existing computer network?" The answer is "Perhaps". You must put your audio on a dedicated sub-net with Quality of Service (QoS), a feature which ensures your audio has priority over less time-critical data.

You also need to check the topology of your network. IP-based protocols place restrictions on how the network is constructed. You mustn't also think that IP-based is always best. It's very common for the audio to travel along adjacent fibre or Cat5 in a building, but to be physically separate from the building's IT network. In this instance using a non-IP network would be fine.

One of the problems to overcome when designing these audio networking standards was to keep the delay in getting the sound from A to B (and C and D and E) to a minimum. Inevitably, with any packeted protocol such as Ethernet, you have to introduce a small delay to the audio so you can put it back together at the other end, allowing for packet collisions. In the first audio networks, this was a problem, especially when trying to synchronise audio to pictures. These days the delays are often just a few microseconds or at worst a few milliseconds. Running faster Ethernet helps a great deal to reduce audio latency.

It is also important to remember that audio networking protocols are designed for transporting audio around a building. If two devices share a CobraNet connection for example, it means that you can send audio from one to another. That is it. There is no ability or standard in the audio industry for inter-device control and communication. Most network protocols allow space in their datastreams for monitoring and control information to be sent along the same network cable. This is normally manufacturer-specific information.

This space for data is not commonly used since the bandwidth available for data may not be sufficient. Realtime level metering from racks of amplifiers might be too much data, when the most important thing is to get the sound there on time. Many manufacturers add a second Ethernet port just for control. It is sensible that this is handled on a separate sub-net.

Given that there is no agreed standard for control between manufacturers, it means that you control your audio system as you always have done, using AMX or Crestron systems or by designing your sound system so that all the networked equipment is from one manufacturer and therefore has one software platform.
Using a separate network for the audio itself does not prevent you from using the building IT network for control, but this often provides the required flexibility without risking disruption to the audio.

We are already seeing signs that the control side is being dealt with in other ways too. Some manufacturers are starting to collaborate with each other to allow control of each other's equipment, and third party manufacturers are introducing universal control systems, such as Stardraw Control that can integrate into an audio network.

The sophistication of some of the audio equipment used in networks can cause problems. This is especially true of networked signal processors that can replace whole racks of equipment with one unit. The problem is that it is tempting and very easy to over complicate your sound system design. You can have sound levels being adjusted at several points or signals being split and routed in confusing ways. It is important to keep things simple and to document your network.

The future
A problem with most network protocols is they have been very specialised and expensive to implement, and only been used on pro-audio equipment. This is fine for connecting together all your fancy audio gear but you haven't been able to do the obvious, such as have a direct audio network connection from an AV matrix, a video conferencing unit or even a standard PC.

Two things might change that. One is a protocol called AVB – audio video bridging. This is a new consumer standard to help network AV systems, but it provides audio professionals facilities such as a guaranteed QoS. A number of major audio manufacturers have joined the AVNU alliance which aims to make AVB work within the systems we all use.

The problem with AVB is that the standard may not be ratified for at least another two years. You also have to use AVB-enabled switches. These may restrict retrofit work if the switches aren't being changed over. Also, even when AVB is ratified, there may not yet be the full set of useful facilities within the protocol that the AVNU alliance is still working on.

Interestingly Audinate, the inventor of Dante, is a member of the AVNU alliance. The company doesn't see AVB as a competitor, but perhaps a protocol that Dante can run. Some think that Dante will become the pro-audio layer within AVB, with the advantage that Dante won't always have to use AVB-enabled switches.
AVB and Dante both allow networked audio to come straight from a PC without additional specialist hardware, so it will be easy for all sorts of manufacturers to add networked audio to their AV equipment. This will most likely cause a massive expansion in the number of networked audio systems, as it will then just be a ubiquitous connection.

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