One Language, One Network

Inside Harman Pro's new HiQnet protocol

By Rick Kreifeldt and Adam Holladay

A little over two years ago, the Harman Pro Group started on a quest to develop a brand new control and communications protocol that drew on the networking experience which existed across each of the Harman brands. The new resulting protocol, HiQnet, is the basis for a complete line of new networked audio products from all Harman Pro companies that together form entire systems targeted at specific markets.

The first system of products launched together with the HiQnet protocol include the AKG WMS 4000 wireless system, the new dbx DriveRack 4800 (*see page 12 of this issue*), the Crown CTs amplifier PIP module family and I-Tech amplifier range, the new JBL VerTec DP-Series with DrivePack technology (*see page 16*), and the Studer Vista 8 digital console. Existing HiQnet products include the dbx ZonePro range and the new BSS Soundweb London flagship networked audio distribution system.

A group of engineers from across Harman Pro has been developing the technologies that underlie HiQnet. The technical and human resource challenges for this group were naturally quite considerable.

The concept for HiQnet at the outset was to develop a single protocol for use in every Harman Pro product, across every pro audio market. When the different needs of a wide range of markets and applications are considered side-by-side, an immense set of requirements unfolds, even when considering two comparatively similar markets such as live sound or performance fixed installation.

In the live sound arena, a sound engineer may be concerned with the speed and responsiveness of the system, whereas in an installed system, the engineer may be more concerned with the flexibility and interfacing of wall controllers, logic, custom control pages and remote access and monitoring.

In considering all of the different markets, the team responsible for the development and refinement of the protocol were faced with another challenge – the need to develop HiQnet to be *transport independent*.

In networking, an underlying technology such as Ethernet, USB, or FireWire is a transport mechanism. Each of these different transports has its strengths for different markets,

applications and therefore products. Simple computer control of a single device is likely to be best achieved with the use of USB, for example.

Ethernet is far more appropriate a transport for products aimed at the larger networks required by today's heavy installation demands and for devices and systems that require remote access via the Internet.

Although Ethernet is fast becoming a more popular method of connectivity to third-party control systems, serial control is still for the most part the adopted standard. The result of the engineers' efforts is that HiQnet lives seamlessly on any transport, simply writing the correct drivers, compatible with Ethernet, USB and serial transports.

This concept also extends to the transport methodologies employed by networked digital audio. Over the last few years, the industry has seen an explosion of different manufacturers and companies offering proprietary digital audio transport.

Each of these concepts has benefits that make them more applicable to certain products and certain markets. HiQnet was designed with a standard way of controlling streaming audio so that it can fit any need in this regard, capable of wrapping around any third-party networked audio protocol to coexist on the same network – and where appropriate – the same cable.

Another challenge presented to the development teams was one of scalability. HiQnet was developed to cover a wide range of system components, from the simple wall controller in the BSS Sounweb London system, for example, to a complex digital console such as the Studer Vista 8.

Using a highly object-oriented approach, the required complexity of each product can be built up without overly burdening any of the simpler devices.

Satisfying all requirements demanded by the diversity of the markets to which HiQnet had to be appropriate, the accompanying technologies employed, and the wide range of complexity of HiQnet devices, led to the formation of a versatile protocol which can be used in any product, across any market.

Control and languages. The term *protocol* itself can be confusing when discussing networking. A protocol can be thought of as a language, but what is confusing in computer networking is that protocols ride on top of other protocols.

They do this with a tiered system, where upper level protocols make use of features of the lower level protocols beneath them. Perhaps a simple way to explain this is that the higher the level of the protocol, the more useful the work it performs.

Figure 1 illustrates a simplified version of some common computer networking protocols. Down at the

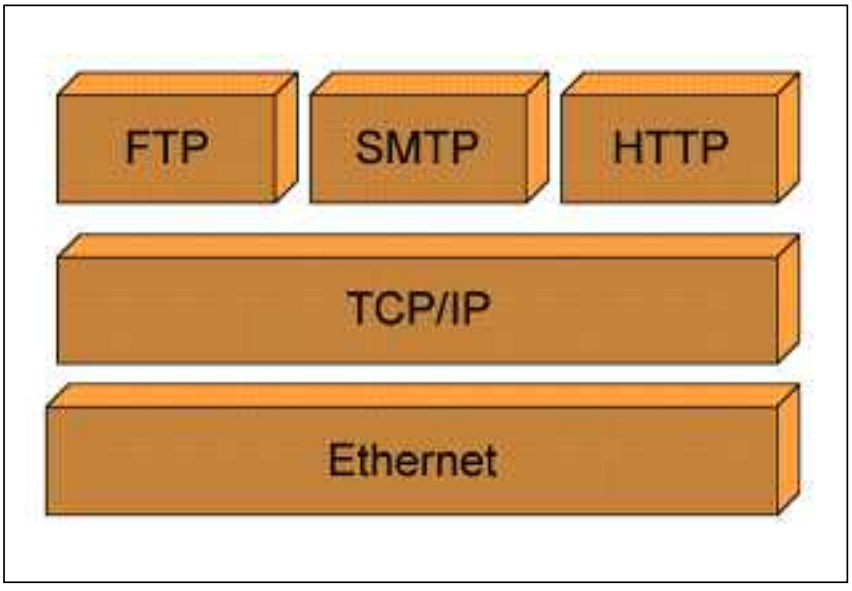

Figure 1: Common computer network protocols, starting with Ethernet and moving on up.

The Signal Chain Under HiQnet

At press time, these devices are specified by Harman Pro as being HiQnet compatible and equipped, with the list expected to expand on a regular basis. An interesting aside is that many of these products have been shipping for some time with HiQnet compatibility already built in, making it easier for recent buyers to incorporate the devices within the new protocol.

AKG WMS 4000 Wireless Microphone System
Studer Vista 8 Digital Console
BSS Soundweb London
dbx DriveRack 4800
dbx ZonePro
Crown I-Tech Power Amplifiers
Crown CTs Amplifier PIP Modules
JBL VerTec Mid-Size Line Array Loudspeakers (Via New DP Series Modules)

Also note that in the April 2005 issue, we will present an exclusive report on the first field application of the new DP Series for JBL VerTec.

- Keith Clark

base level, we have Ethernet, the development of which was started in the early 80's, and really is concerned with transporting the actual bits of data across cables (or increasingly commonly today wirelessly) between computers.

TCP/IP, or Transmission Control Protocol/Internet Protocol, provides reliable packeted or bundled transmission of data. With the Ethernet and TCP/IP layers, messages can be sent across the Internet. Nothing can really be done with this information, however.

To make use of this principle, the next layer up in our tier includes mechanisms like FTP, or File Transfer Protocol, which as it implies is for the transfer of data files, SMTP, for sending mail, and HTTP, for web services.

It's really these final upper layers that we make use of day in and day out on our computers when surfing the web or sending e-mail. In a similar way, HiQnet is an upper layer protocol designed for doing the really useful work. **Figure 2** shows the generalized HiQnet model.

The required complexity of each product can be built up without overly burdening any of the simpler devices

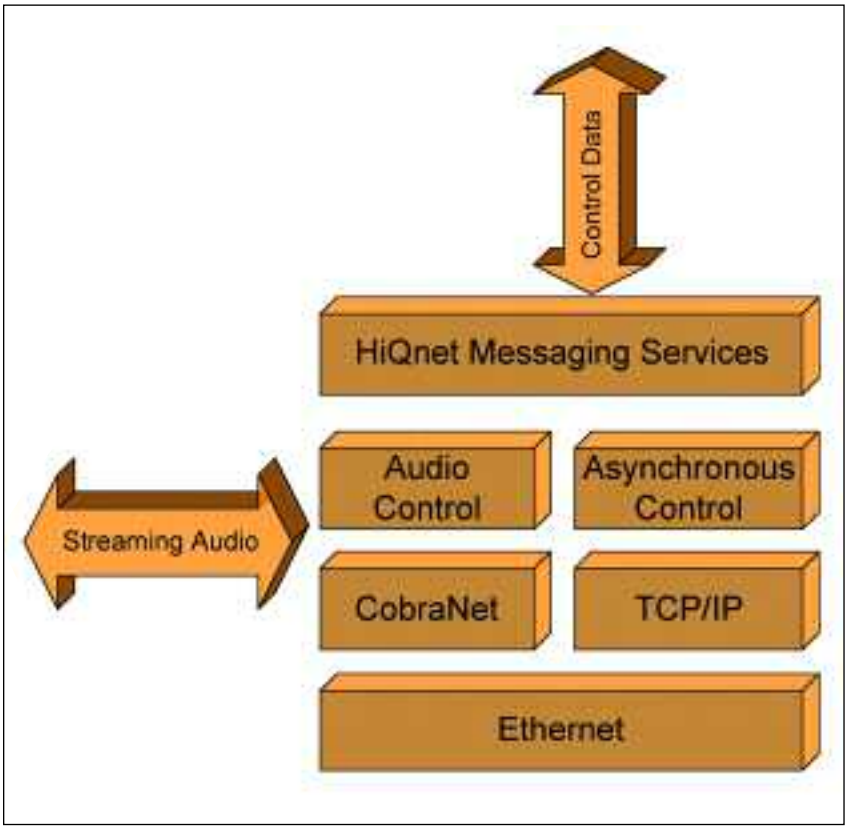

Figure 2: Generalized HiQnet model.

Walking through the diagram from the lower levels upward, again, we can see that the network relies on some physical medium responsible for actually transporting the data. Examples of these would include Ethernet, Serial, USB, etc.

On the right is an asynchronous control stack. We assume some kind of packet services, and then we have an asynchronous control layer, and then finally, HiQnet messaging services on top of these. On the left are the streaming audio handlers, with audio control and audio services.

In the HiQnet Ethernet implementation, current Harman Pro products make use of CobraNet to stream audio and TCP/IP for packetizing the asynchronous control.

An extra benefit of HiQnet is in the upper layer management services that are provided for CobraNet. CobraNet streams the audio between products, but two or more HiQnet devices can be made to be more "plug and play" and collectively intelligent because this upper layer control automatically configures all of the lower levels.

Further, the HTTP service automatically configures the IP layer below it. Thus HiQnet can simplify the design process by offering a simple interface and gateway to what is fast becoming a complex IT world.

Of course, to perform very sophisticated tasks, a comprehensive control software package is required. New HiQnet products are being configured for the new HiQnet configuration, and the control software application – Harman Pro System Architect – has been created from the ground up around the HiQnet architecture.

Written entirely in C# and employing Microsoft .NET technology, System Architect employs a plug-in architecture that enables development of a core feature set by a newly founded Harman Pro central technology center. This was simultaneous to the development of plug-in dlls (dynamic link

libraries) for individual products from individual Harman Pro brands, as shown in **Figure 3**.

Bringing it together. The most important aspect is what happens when a system of HiQnet products is brought together. The concept is to arrive at a job site, un-box all the differently functioning devices, plug them all into the network along with the design computer, and then have complete control of every device in the signal chain, from microphone to loudspeaker.

All HiQnet devices conform to the Universal Plug and Play (UPnP) standards, so in the majority of situations, the system designer/engineer will not even have to consider IP addresses. HiQnet products automatically negotiate their IP addresses between themselves – addresses are automatically set by plugging the device into the HiQnet network.

The benefits of one system on one protocol run from the sophisticated, like complete monitoring and reporting of the entire system in one application, to the mundane, like having a complete backup of the entire configuration of the system in one file.

HiQnet and System Architect negate the need to switch between several different control applications to isolate a problem with one of the many devices somewhere on the network, especially when some of them will not run simultaneously on the same computer.

The HiQnet system allows the user to control any HiQnet-equipped device in the system, be it a microphone, a powered loudspeaker, an amplifier, a mixer or a processor, using the same commands and functions. The single interface System Architect can cut the learning curve – once the designer/engineer has learned how to use one HiQnet product, knowledge of the rest follows.

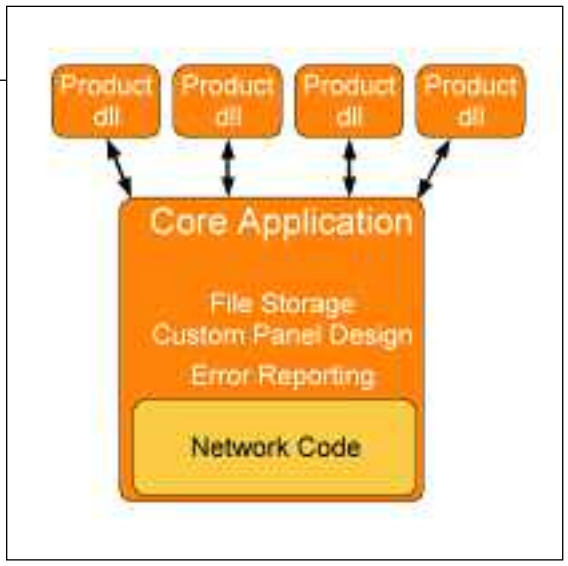

Figure 3: System Architect control software architecture.

In a multilingual world, the communicator is king. From microphone, to console, to DSP, to amplifier, to loudspeaker – now one language can be spoken. ■

Rick Kreifeldt *is vice president of the Harman Pro System Development and Integration Group (SDIG), while* Adam Holladay *is SDIG market manager. Reach Adam at aholladay@harman.com.*

Aviom A-Net Pro: Added Capacity And Control

Another recent development is the AVIOM16/o-Y1, an expansion card for all Yamaha digital mixers supporting the mini-YGDAI format.

Because the Aviom A-Net was originally conceived for live stage monitor applications, the protocol was designed to transmit in only one direction: from the A-Net input module or distributor hub out to the performers' mixers. In addition, the protocol was built to carry 16 channels.

New A-Net Pro is bi-directional and has notably increased capacity. This new version of the protocol carries up to 64 audio channels on a single wire pair in a CAT-5 cable, at 24 bits. In specialized networks, A-Net Pro can carry 256 channels.

In addition, the protocol has dedicated bandwidth for bi-directional talkback, plus Virtual Data Cables (VDC). These can be assigned to multiple simultaneous different data types, such as MIDI, RS-232, and GPIO.

Using the VDCs, users can distribute data throughout the A-Net Pro network without installing additional cable, creating a hybrid network with high-bandwidth data capability, all over standard Ethernet-type cable.

A-Net Pro also provides flexibility in sample rate and clocking. The Pro64 ASIC supports variable sample rates within three ranges: 39 kHz to 52 kHz (for 44.1 kHz and 4 8kHz applications), along with 2x (96 kHz) and 4x (192 kHz).

Additionally, an A-Net Pro network can sync to the digital clock in any unit; that is, any unit in the network can be set as the audio clock master. Alternatively, the A-Net Pro network can be synchronized to an external master clock from any point in the system, useful for applications such as synchronizing to digital consoles.

A-Net Pro offers two methods of distributing audio channels. In Auto mode, A-Net Pro self-configures into a 64-channel "omni-directional" audio network, with no upstream or downstream signal flow limitations. In Manual mode, up to 128 discrete channels are available on a single cable: 64 channels on one wire pair and 64 different channels on a second pair, heading in the opposite direction.

A-Net Pro can work without a dedicated PC and without PC-based configuration. However, the Pro64 ASIC's Application Processor Interface will allow PC-based network management as an option. With other audio manufacturers, Aviom will develop software applications for use with the A-Net Pro protocol.

The company expects to launch a new line of networking products based on the A-Net Pro protocol beginning in quarter three of this year. In addition, the A-Net Pro64 ASIC will be introduced in mid-2005. (The November 2004 issue includes a full report on A-Net Pro.)