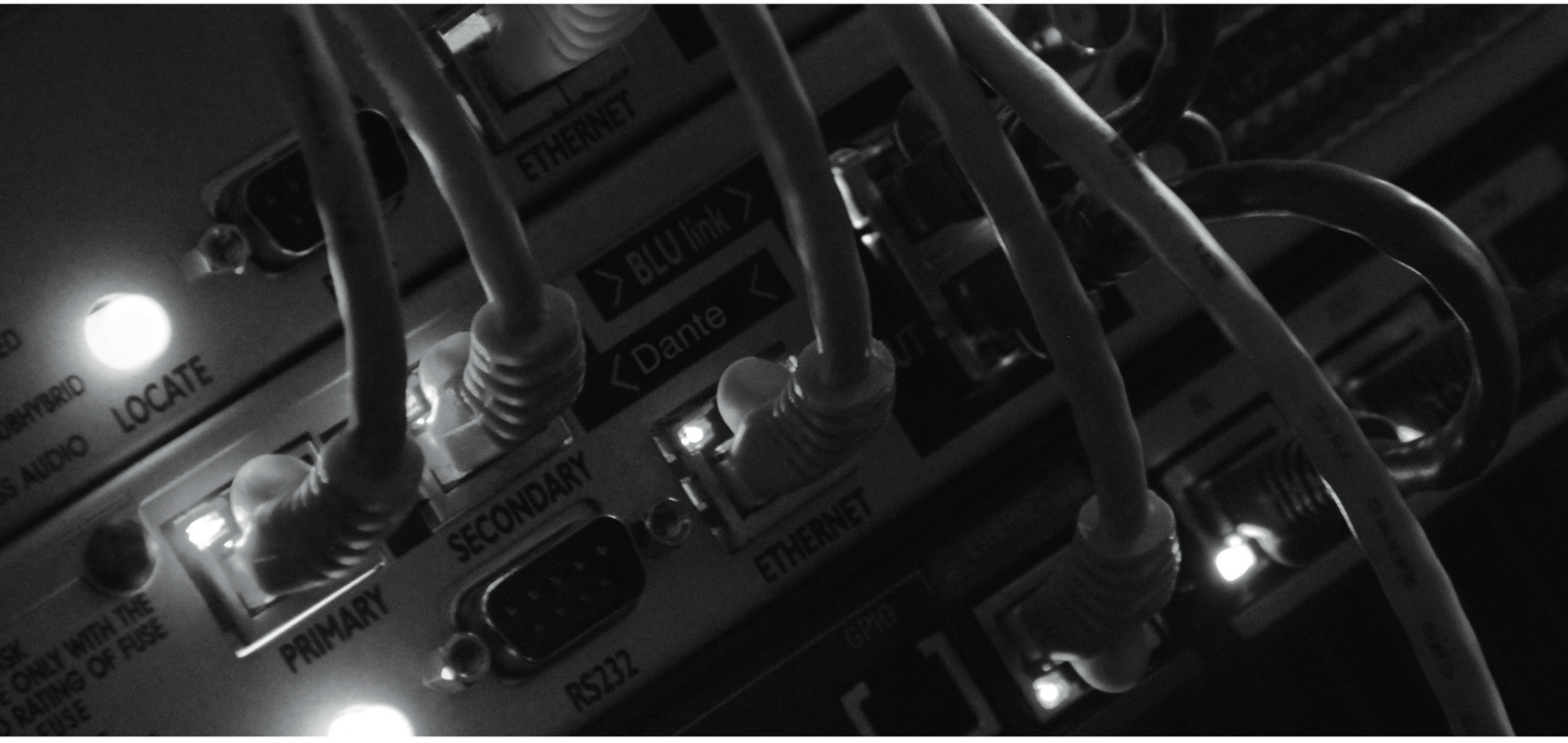


BSS crown HiQnet

ARCHITECTURAL MEDIA SYSTEMS

GUIDE TO AUDIO NETWORKING

revision c, JUNE 2013

GUIDE TO AUDIO NETWORKING : CONTENTS

HiQnet : AUDIO SYSTEM CONTROL

HiQnet is Harman's proprietary control protocol and is the mechanism by which HiQnet devices communicate with each other and control software such as HiQnet Audio Architect or HiQnet Performance Manager. HiQnet itself is not a mechanism for transmitting audio from device to device. It does play a significant part when setting up audio systems and networks, however, as it is used to inform devices on the network which audio signals to transmit and which to receive, regardless of which audio transport they are using.

HiQnet is also responsible for enabling the configuration of devices, including any signal processing, from a computer, whether over an Ethernet network or via a USB connection.

The HiQnet control protocol remains proprietary to Harman as it provides an extremely deep level of definition to control so many device types. Meanwhile, the choice of audio transport employed on a network can be wide and varying. Harman provides a great number of options within a HiQnet audio system for this purpose. HiQnet was designed to coexist well with any network transport, and to provide additional audio network configuration capabilities above and beyond that simply offered by the audio transport itself.

Harman's expertise in audio networking dates back over fifteen years, and today Harman offers the widest range of audio networking protocols on a single control platform.

CIRRUS LOGIC COBRANET : THE TRADITIONAL APPROACH

Harman's traditional networked audio distribution methodology has been CobraNet, developed originally by Peak Audio and then later by Cirrus Logic. CobraNet uses a standard 100BASE-T Fast Ethernet switched network to distribute the audio – up to 32 channels to and 32 channels from each CobraNet device over a single CAT-5 or CAT-5e cable, with a maximum cable length of 100 metres (328 ft) between a device and a network switch. The total number of channels which can be transported across a network is dependent on several factors, but with careful network management can provide hundreds if not thousands of audio channels. Such network management is fairly complicated and requires a good understanding of network configuration, however.

Similarly with careful switch management, CobraNet audio can co-exist with other traffic on existing infrastructure such as a company network. Separating the audio network from a business network is the more recommended approach to ensure any heavy bursts of non-audio data do not swamp the network and interrupt the time-critical audio data, resulting in unwanted pops and clicks.

Harman continues to produce and support many CobraNet-enabled devices, including BSS Audio Soundweb London processors, Crown amplifiers, and Soundcraft consoles. JBL has also produced CobraNet-capable VerTec powered array loudspeakers, although these models are no longer available.

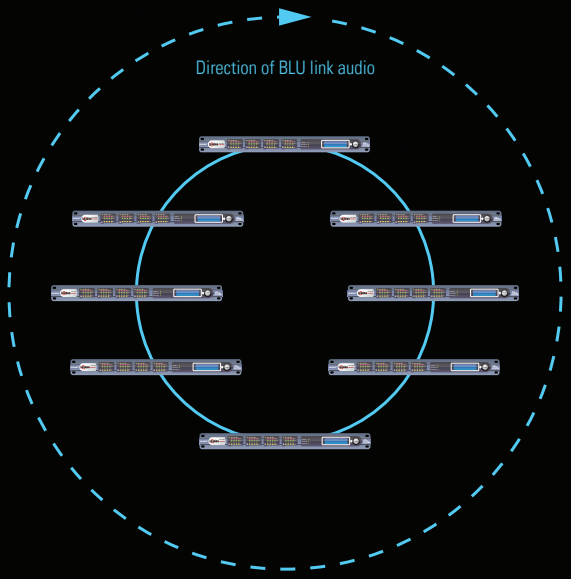
EXPANDING THE NETWORK WITH HARMAN BLU LINK

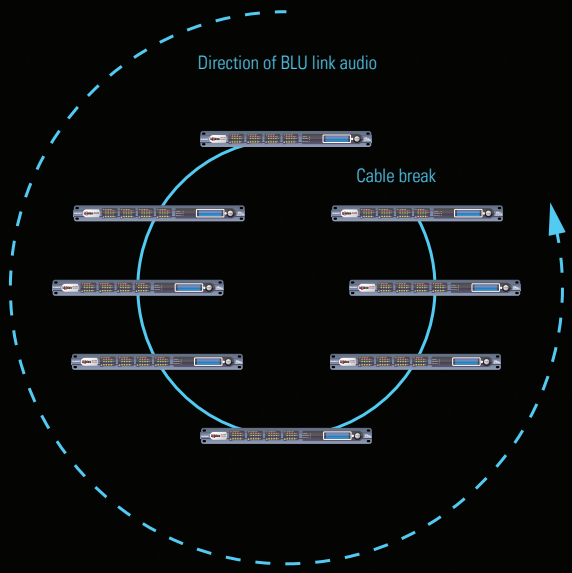
While CobraNet has become the de facto standard for audio networking in the professional audio industry as we know it, as demands for channel count in and out of a device increase, CobraNet's 32-in and 32-out cable channel capacity has become limiting.

To complement the CobraNet network and solve the channel count limitations, Harman developed the BLU link high speed digital audio bus. BLU link was designed originally to expand the matrix capabilities of the BSS Audio Soundweb London platform by linking devices directly together, but has since been adopted in Crown amplifiers, Soundcraft consoles and dbx personal monitor mix systems.

BLU link is not an Ethernet-based transport. While it also distributes audio over the same standard CAT-5e cabling as CobraNet, it doesn't require an Ethernet switch infrastructure. In fact BLU link will not pass through an Ethernet switch. Instead, devices are wired directly together in a ring to form a closed BLU link bus. All connected devices can add channels to the BLU link bus – including from the local analog, digital or networked audio inputs – and source channels from it, up to a maximum determined only by the individual device specifications. The BLU link bus is fully redundant and supports a total number of 256 channels at 48kHz, or 128 channels at 96kHz – both at 24-bit. BLU link is very simple to configure and lends itself well to the simple connection of locally placed devices.

A BLU link bus is best configured in a ring, effectively by connecting the last device back to the first. The 256 BLU link audio channels travel around the ring. Signals from source devices are added onto the bus, and dropped off at their destination devices as the audio passes around. With this concept, BLU link can also achieve redundancy. If any of the cables in the ring should break, be disconnected or fail for some reason, the audio on the bus simply travels around the other way, to ensure click-free failover.





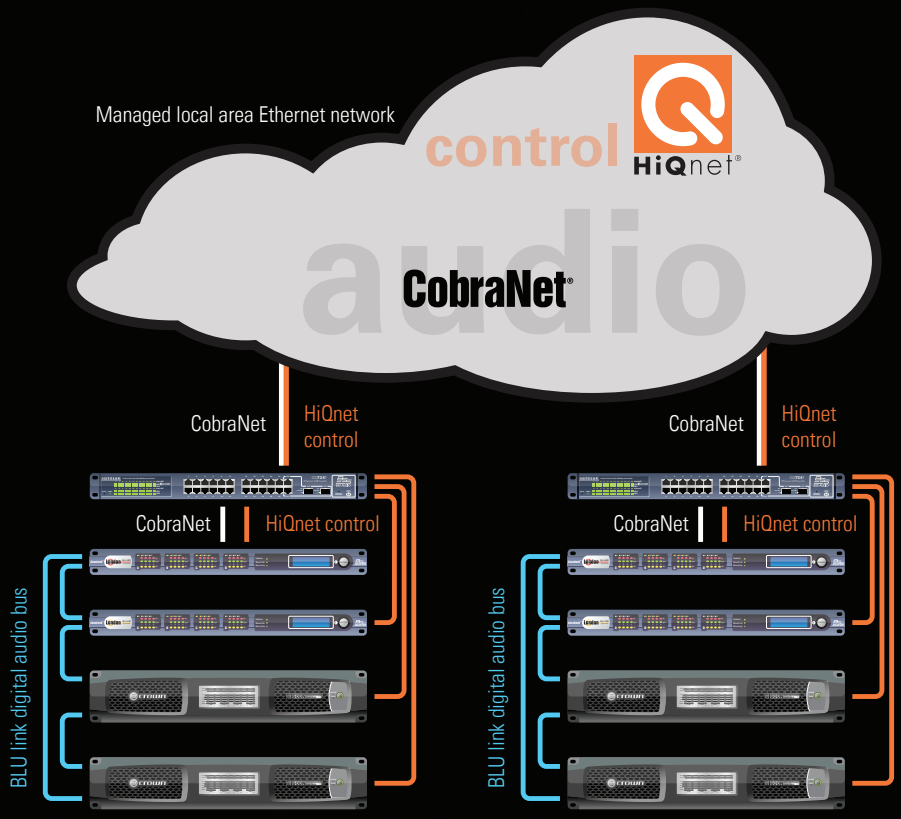
BLU link audio can be transmitted from device to device with a maximum CAT-5e cable length of 100 metres (328 ft). It can also be converted to fiber for much longer runs with the BSS Audio MC-1 media converter. A maximum of 60 BLU link devices may be connected in a single ring.

HiQnet control data is not distributed on the BLU link bus. A separate Ethernet network must coexist for HiQnet control. If appropriate, this could be the same network as is used for Ethernet audio transport, such as using the CobraNet network when BLU link and CobraNet are combined.

COBRANET AND BLU LINK HYBRID TOPOLOGY

CobraNet and BLU link together provide a very versatile audio distribution system. We can leverage both enterprise level networks for audio distribution to rack rooms (CobraNet), and local bus networks (BLU link) within the rack room.

A good example of a hybrid use case would be for amplifiers to source audio channels from a Soundweb London device locally within rack or rack room, while the source Soundweb London device is connected to the main Ethernet-based audio network for wider distribution of audio across the venue.

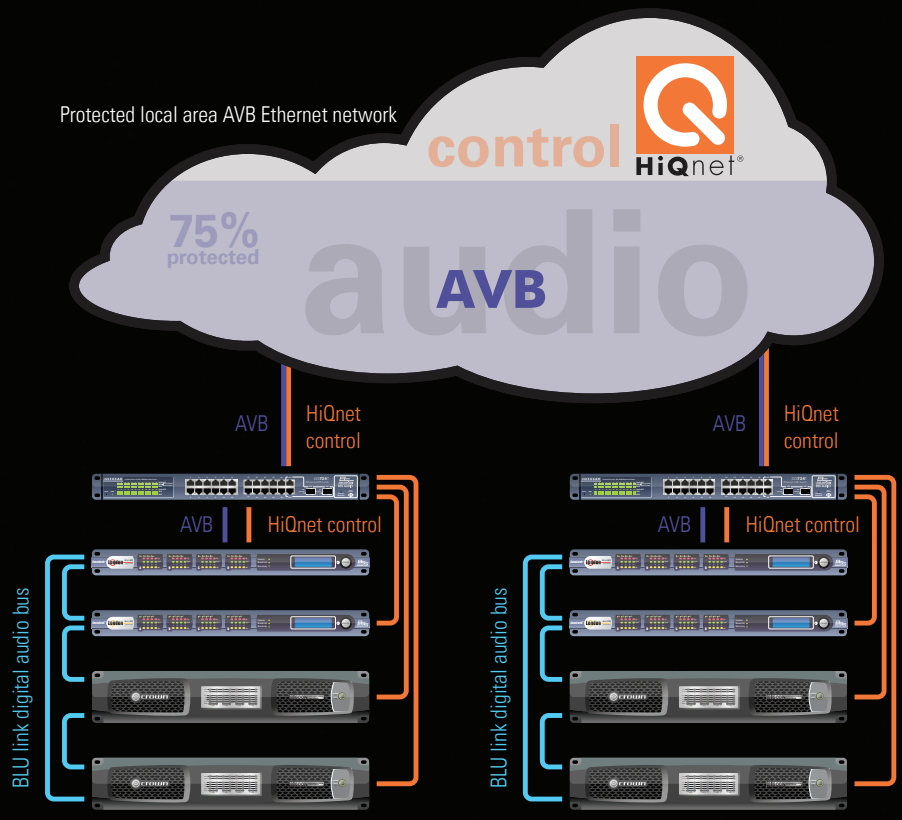


In the diagram, audio is distributed across the facility from and to BSS Audio Soundweb London devices in rack rooms. Within each rack room audio is distributed to other Soundweb London devices and Crown amplifiers using BLU link. The BLU link bus has the capacity to distribute all of the channels within the rack room – including redistributing CobraNet audio, as well as any additional audio that only needs to be sourced and distributed locally between the devices in the rack.

Since the BLU link bus is audio alone, and does not carry control information, control data remains distributed over the enterprise network.

AVB : AUDIO VIDEO BRIDGING

Even with the increased flexibility of the CobraNet and BLU link hybrid topology, as system requirements demand greater and greater channel counts on the Ethernet network, there comes the need for a next generation Ethernet-based audio network. For many convincing reasons, Harman sees AVB as the future of media networking.



- AVB is an open standard – there need not be license fees for a manufacturer to pay a third-party. This lack of royalty fees for an individual device results in total system cost reduction – often dramatically.
- AVB represents a change in the way the Ethernet network works. The AVB Ethernet switches on the network reserve up to 75% of the entire data bandwidth for media traffic. Nothing else can interrupt the audio and video data, and therefore the risk of any unwanted clicks and pops is eliminated.
- Audio and video data packets are transmitted from a source device with a 'time-to-play' stamp. This mechanism of clocking the network means that network latency is precise at all destination devices, multiple sample rates can exist and audio and video data remain perfectly in sync over the network.
- An AVB network can include devices and switches with 100MB, 1GB and in the future 10GB Ethernet and more, meaning it is truly future-proof.

In order to understand how and why AVB is such a significant development for the pro AV industry let's take a quick technical look.

Ethernet is divided into seven layers, from the physical layer (the Ethernet switch / cable – layer 1) all the way to the application layer (an email software program, for example – layer 7). Most of our day-to-day network data is transmitted on layer 3 as IP (Internet Protocol) traffic, including some proprietary audio and video protocols. AV transports will always be prone to interruption from email, web and other internet or local area use unless implemented on a separate, dedicated network. Even in this situation, often complex network management is still required in order to protect audio and video traffic from non-media data – and itself. It has become increasingly commonplace for small AV firms to need to employ IT staff just to configure their networks.

The application layer provides networking services to software programs such as HiQnet Audio Architect and Performance Manager, and email and web applications.

The presentation layer is responsible for converting application data to network data and vice versa. It is highly instrumental in tranlsating between a HiQnet software application and the communication with devices on the network, for example.

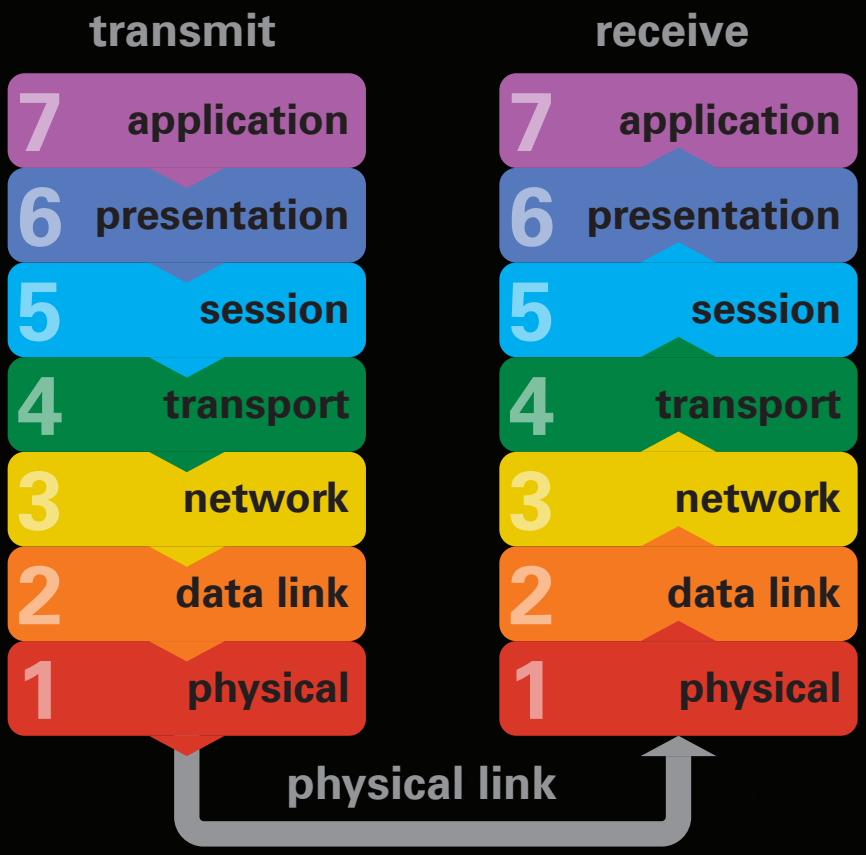
The session protocol defines the transmitted data format. It is largely irrelevant for understanding audio transport. HiQnet control data is transmitted over layer 5.

Two transport protocols sit at layer 4 - TCP and UDP. TCP establishes IP connections and ensures delivery of data. UDP has a lower oeverhead and provides transmission without ensuring data deliver. Most HiQnet data is TCP, although HiQnet meter data is transmitted via UDP.

IP traffic is communicated over layer 3, devices identifying themselves with IP addresses. IP data is packetized by the transmitting device for transmission over the Ethernet data link layer, and reassembled at the receiving device. Dante is a layer three audio transport. Routers are layer 3 devices.

Put simply, layer 2 is Ethernet. Ethernet data is communicated over the network from device to device at using low-level Ethernet or MAC addresses to identify each other. AVB and CobraNet traffic are transmitted over layer 2. Switches are layer 2 devices.

Cable or other physical medium. In the case of AVB, BLU link, CobraNet and Dante, layer 1 is the CAT-5e cable. Very low-level protocols can be transmitted directly at layer 1 such as BLU link. In these cases an Ethernet switch is not required. Hubs are layer 1 devices.



AVB is the solution to this. It provides the majority of its benefits due to the simple fact that the time-stamping and protection of the media data using the Stream Reservation Protocol are employed on layer 2 and therefore based on the very foundations of Ethernet technology. To put it another way – AVB is Ethernet, Ethernet is AVB. It won't be long before we can pipe AVB directly in and out of the Ethernet port on our computers without any need for any special software. AVB is the highway and the highway patrol.

Since the majority of this significant technological advancement has happened at a lower layer of Ethernet, at the switch level, dedicated AVB Ethernet switches are required to form the backbone of an AVB network. Without these switches, the benefits of AVB are lost. Several switches are available today – the BSS Audio / NETGEAR GS724T is one example. Extreme Networks produces an enterprise level switch, and Lab X Technologies produces a 5-port switch for smaller applications.

As AVB is an Ethernet-based transport, CAT-5e cable is employed for connections up to a maximum cable length of 100 metres (328 ft) between a device and a network switch.

AVB is an open standard, and while that is potentially a cost benefit to manufacturers and customers alike because it is not a proprietary royalty-based technology, no one company 'owns' it. The Institute of Electrical and Electronics Engineers (IEEE) develop the standards, as they do many others, but they do not police correct implementation of AVB or support it in the field, as a third-party proprietary transport developer might. As a result, the AVnu Alliance has been formed – with Harman being a founding member – to develop certification programs in order to ensure interoperability between devices. Where you see the AVnu Alliance logo on a device or a switch, you can be confident that audio and video data can be shared between them. The AVnu Alliance is made up of 48 member companies – including significant silicon chip manufacturers, core brand-name Ethernet switch manufacturers, solutions providers, several pro audio and video manufacturers, prominent consumer electronics manufacturers, automotive giants and interoperability test houses.

Interoperability certification programs will go into operation for AVB Ethernet switches in 2012 and professional audio devices in 2013.

For more information on the AVnu Alliance, visit www.AVnu.org.

AVB AND BLU LINK

Just as CobraNet and BLU link are very complementary technologies, so too are AVB and BLU link. AVB provides a more versatile network backbone than CobraNet by increasing channel count, optimizing bandwidth and reducing configuration complexity, while BLU link continues to be extremely suitable for audio distribution to amplifiers within a rack or even amplifiers and processors within an entire rack room.

To this end, the combined AVB and BLU link topology looks very similar to the CobraNet and BLU link topology. The only difference is that dedicated AVB switches are required, in order that the considerable benefits of AVB can be achieved.

In this way, AVB audio can be distributed across the facility from and to BSS Audio Soundweb London devices in rack rooms. Within each rack room audio is distributed to other Soundweb London devices and Crown amplifiers using BLU link.

Just as before, since the BLU link bus is audio alone, and does not carry control information, control data remains distributed over the AVB enterprise network.

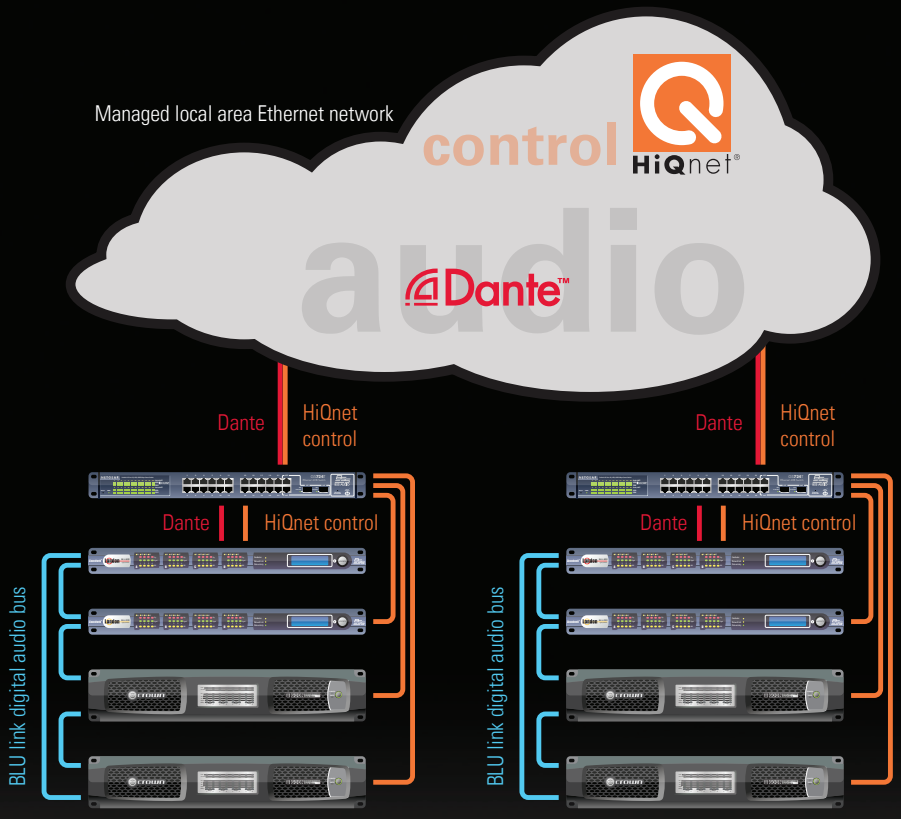
AUDINATE DANTE

While AVB adoption increases, there is still a need within the industry to support a suitable layer 3 technology which can be carefully managed over non-AVB Ethernet switches to provide high channel count solutions. Harman has selected Audinate's proprietary Dante solution for this purpose. Other than AVB, Dante is really the only other current-generation Gigabit transport to have been adopted by several manufacturers across the pro audio industry, and so in choosing Dante we also ensure good interoperability with many other devices.

Dante will often require careful switch management by someone with expertise in creating subnets and VLANs (Virtual Local Area Networks), particularly as the scale of the system and the complexity of the audio routing within it increase. Additional documentation can be found at www.audinate.com.

As Dante is an Ethernet-based transport, CAT-5e cable is employed for connections up to a maximum cable length of 100 metres (328 ft) between a device and a network switch.

As before, the hybrid network BLU link topology is also compatible with Dante in place of CobraNet or AVB.



COMPARING AVB AND DANTE

With the hybrid BLU link topology, AVB and Dante can be used as direct replacements for CobraNet. Both AVB and Dante have their strengths and weaknesses, however, which must be summed up when determining the correct networked audio transport for the system.

AVB AND DANTE : FEATURE COMPARISONS

	AVB	DANTE
Maximum channel count	400 in, 400 out	512 in, 512 out
Gigabit link	• 48kHz / 24 bit • Guaranteed delivery	• 48kHz / 24 bit • Delivery not guaranteed
Maximum sample rate	No limit • AVB does not define a maximum sample rate • Manufacturers may support any sample rate • AVnu-certified devices must support 24kHz / 24-bit	192kHz • Certain Dante hardware limited to 96kHz
Latency	2ms (standard)	5ms (150us)
Gigabit link	• May be reduced by manufacturer	• 5ms is the suggested safe value • 150us with only one switch in the network
Presentation time	Yes • Synchronized presentation across the entire system	Partial • Latencies can be aligned ona device-by-device basis
Redundancy	Not defined • Manufacturer-specifc implementation	No
Support for video	Yes • Silicon exists to handle video • Inherently synchronized with audio	No
PC network soundcard	Yes • Native to Thunderbolt-equipped Apple computers • Multiple support in NIC chipsets	Yes • Audinate-supplied virtual soundcard

AVB AND DANTE : NETWORKING COMPARISONS

	AVB	DANTE
Topology	Switched network	Switched network
Switch support	Yes • AVB-capable swithces only	192kHz • Requires full-managed switch
Router support	No • Audio can only be passed between devices on the same subnet	Yes • Audio can be sent over subnets
CAT5e cable distance	100m	100m
Fiber support	Yes	Yes
Open standard	Yes • Designed using existing and new IEEE standards	Partial • Audio transport is built on existing standard protocols but implementation is proprietary • Dante control protocol is non-standard

AVB AND DANTE : NETWORK MANAGEMENT

	AVB	DANTE
Requires switch management	No	Yes (for larger systems)
VLANs required	Automatic	Yes (for larger systems)
Guaranteed bandwifth	Yes • Bandwidth is guaranteed by the AVB switches	No • Good configuration and management can provide shigh level of confidence
Quality of service	Yes • New standards provide best-in-class QoS	Yes • Good configuration and management can provide some QoS, although not guaranteed

AVB AND DANTE : CONTROL

	AVB	DANTE
Common control protocol	IEEE 1722.1 • Open standard for device discovery, enumeration, command and control	No • Dante-specific protocol employed for configuration of audio routing
Common controller	In development • Online routing and basic control	Dante Controller • Online routing only
Network supports control data	Yes • 25% of bandwidth reserved for control data, separated from media data	Yes • Control data coexists on same network as audio data • Requires good switch management

AVB AND DANTE : BUSINESS

	AVB	DANTE
Organization	IEEE / AVnu Alliance • IEEE develops AVB open standards • AVnu Alliance develops interoperability certification programs	Audinate
Number of members / licensees	47 AVnu Alliance members • As of October 2012	23 Dante licensees • As of October 2012

USING TRANSPORTS TOGETHER

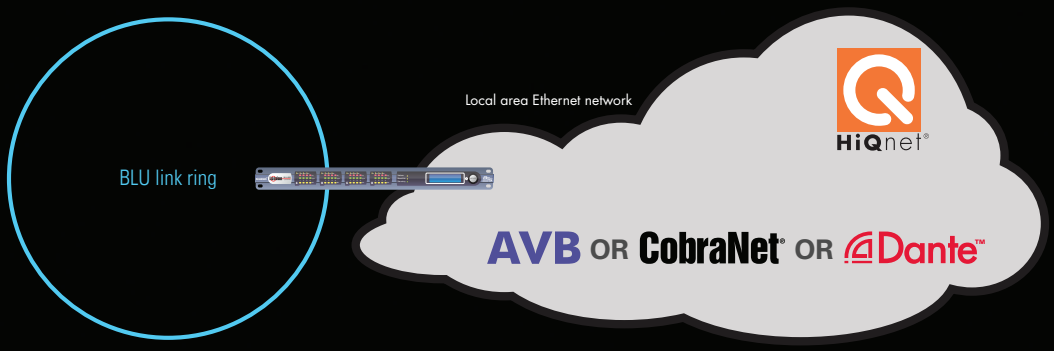
Important attention must be paid to how the system is clocked in hybrid use cases.

When using BLU link with any of the three Ethernet-based transports, there are certain guidelines which must be followed.

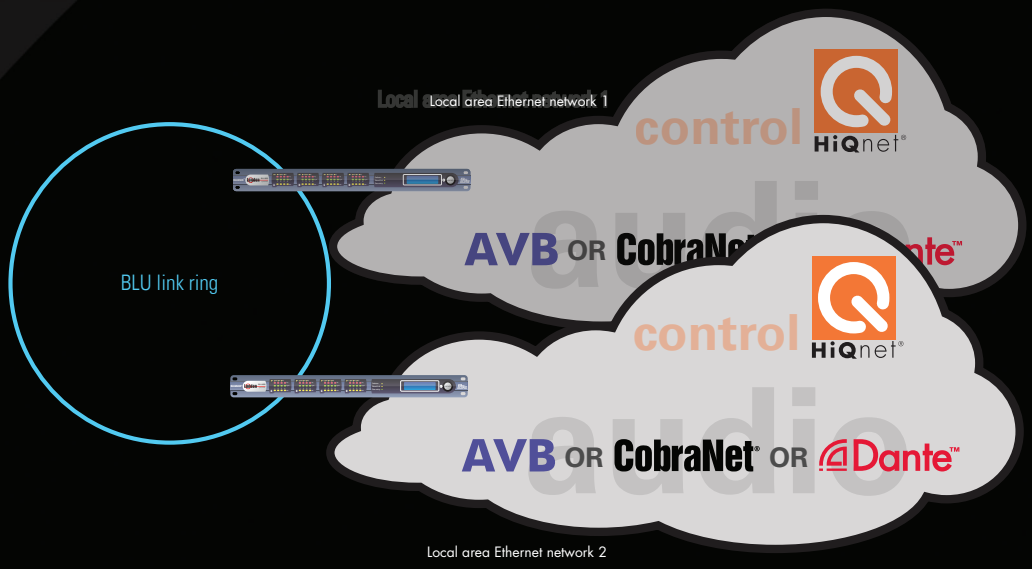
The overarching rule is that there must be a single device which acts as a clock master for systems which utilize more than one transport. In a system with a single transport, whether AVB, CobraNet, Dante or BLU link, the master device is determined within the configuration software. Here, setting an order of priority of which devices can be the master clock order also enables manual determination of how the system will behave in failover conditions.

In a combined system of BLU link and an Ethernet transport (AVB, CobraNet or Dante), the BLU link ring will slave to the clock provided by the Ethernet transport master clock device, whether it is directly part of the BLU link ring or not.

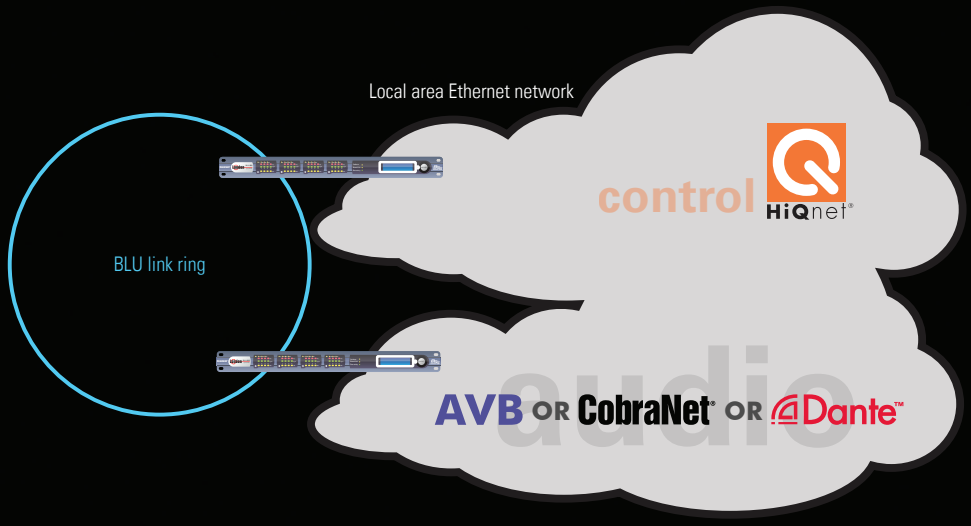
This has implications on network / BLU link design. For example, in this system a single device can be master, as it exists within both the Ethernet transport network and the BLU link ring:



In this topology, however, the BLU link ring links two separate Ethernet transport networks – each of which demands a clock master – and therefore the BLU link ring does not have a single master clock to which to slave:



The system above must therefore be fixed by connecting the two Ethernet transport networks together so they share the same clock, even though there may be no audio passing between them:



Perhaps one of the most practical uses of the combination of an Ethernet transport network and BLU link is using a central Ethernet network cloud to transmit audio between racks or even between rack rooms, and then distribute audio locally with several BLU link rings within the rack or room:

An AVB system can have more than one clock master since it can include multiple sample rates on multiple domains. There can be only one 'PTP (Precision Timing Protocol) Grand Master' device which synchronizes all devices within the system to the presentation time, while there is one 'Media Clock Master' device for each separate sample rate domain. The clock master functionality is simply the responsibility of devices within the AV system – specialized clock devices are not required. Which device acts as master is configured with a series of priorities within configuration software such as HiQnet Audio Architect.

A CobraNet clock master device is called the Conductor, and is responsible for sending out a beat packet to determine 48kHz or 96kHz to all devices within the system. Consequently, a CobraNet system can employ only single sample rate.

The Dante master device is referred to as a Master Clock device. Again, only a single device may be the master and only a single sample rate is therefore possible for a Dante network at any one time.

A BLU link clock master device is known as the Clock Master device. In a BLU link only system, the device will synchronize other devices to either 48kHz or 96kHz, in a combined Ethernet transport network system, all BLU link devices will slave to the clock provided by the Ethernet transport network clock master.

In certain cases, it is possible to use devices of more than one Ethernet transport type (AVB, CobraNet, or Dante) connected within the same BLU link ring. In other words, with careul design it is possible to design a Harman system which actually includes more than two Ethernet-based transports n addition to BLU link. For example, a Harman system can convert CobraNet audio to BLU link audio with either a BLU-800 or BLU-320, and then convert BLU link to Dante with either a BLU-806 or BLU-326. The possibilities are goverened by how each transport has been implemented in the Soundweb London hardware, whether one transport can 'slave' to a clock generated by a second transport. Currently BLU link and Dante implementations may slave to a different clock.

Any Soundweb London system supports the following five multi-transport combinations:

BLU link + AVB	AVB provides the clock
BLU link + CobraNet	CobraNet provides the clock
BLU link + Dante	either BLU link or Dante provides the clock
BLU link + Dante + AVB	AVB provides the clock
BLU link + Dante + CobraNet	CobraNet provides the clock

Any multi-transport combination not specifically listed above is not possible in Soundweb London systems, without being forced to use analog interconnects between devices. For example, BLU link + AVB + CobraNet is *not* possible, because the AVB and CobraNet networks would each be synced to their own, different clocks.

HiQnet PRODUCT COMPATIBILITY CHARTS

BSS AUDIO

	BLU link	AVB	CobraNet	Dante
Soundweb London BLU-806	•			•
Soundweb London BLU-805	•	•		
Soundweb London BLU-800	•		•	
Soundweb London BLU-326	•			•
Soundweb London BLU-325	•	•		
Soundweb London BLU-320	•		•	
Soundweb London BLU-160	•			
Soundweb London BLU-120	•			
Soundweb London BLU-102	• [48kHz]			
Soundweb London BLU-101	• [48kHz]			
Soundweb London BLU-100	• [48kHz]			

CROWN

	BLU link	AVB	CobraNet	Dante
CTs 4200USP/CN			•	
CTs 8200USP/CN			•	
CTs 2-channel Series with PIP-USP4/CN fitted			•	
CTs 2-channel Series with PIP-BLU fitted	•			
DCi Network Series	•			
I-Tech HD Series			•	
I-Tech 4x3500 HD			•	
VRACK 12000			•	
VRACK 4x3500			•	

dbx

	BLU link	AVB	CobraNet	Dante
SC 32 digital matrix processor with AVB card fitted		•		
SC 64 digital matrix processor with AVB card fitted		•		

SOUNDCRAFT

	BLU link	AVB	CobraNet	Dante
Si Expression Series	• [optional]		• [optional]	• [optional]
Si Performer	• [optional]		• [optional]	• [optional]

TECHNICAL SPECIFICATIONS

AVB

Transport type:	Switched network
Layer:	Layer 2
Supported sample rates:	No restriction
Supported bit depths:	No restriction
Channel packetization:	Streams (1 to 400 channels)
Latency:	2 ms standard, may be reduced in manufacturer's implemetation
Maximum channel count:	400 in (single stream), 400 out (single stream) Gigabit, 48kHz / 24 bit As number of streams increases, channel count decreases Channel count lower than 512 x 512 due to the benefit of bandwidth reservation – 75% for media, 25% for non-media
Maximum CAT-5e cable length:	100 metres (328 feet)

Cirrus CobraNet

Transport type:	Switched network
Layer:	Layer 2
Supported sample rates:	48kHz, 96kHz
Supported bit depths:	16, 20, 24
Channel packetization:	Bundles of 2 or 8 channels
Latency:	5 1/3 ms (default), 2 2/3 ms, 1 1/3 ms
Maximum channel count:	32 in, 32 out (device implementation specific) Bundle channel capacity varies as below:

	48kHz 16-bit	48kHz 20-bit	48kHz 24-bit	96kHz 16-bit	96kHz 20-bit	96kHz 24-bit
5 1/3 ms	8	8	7	4	4	3
5 1/3 ms	8	8	8	8	8	7
5 1/3 ms	8	8	8	8	8	8

Maximum CAT-5 / CAT-5e cable length:	100 metres (328 feet)

Audinate Dante

Transport type:	Switched network
Layer:	Layer 3 (IP routable)
Supported sample rates:	48kHz, 96kHz, 192kHz
Supported bit depths:	16, 20, 24
Channel packetization:	IP packets
Latency:	Variable from 83.3µs (device direct to device, not over network) Increases with higher channels per IP packet
Maximum channel count:	512 in (single IP packet), 512 out (single IP packet) Gigabit, 48kHz / 24 bit
Maximum cable length:	100 metres (328 feet)

Harman BLU link

Transport type:	Proprietary ring
Supported sample rates:	48kHz, 96kHz
Supported bit depths:	24-bit
Maximum channel count:	256 at 48kHz, 24-bit 128 at 96kHz, 24-bit
Channel packetization:	N/A
Latency:	11 samples from transmitting device to first receiving device, 4 samples from device to device thereafter
Maximum cable length:	100 metres (328 feet)

OTHER AUDIO PROTOCOLS

Harman's networking technologies of the future are AVB and Dante, with the BLU link bus to complement either and add additional routing flexibility. CobraNet will continue to be supported, although it is likely that we will see fewer and fewer CobraNet devices released. There are a handful of other audio protocols which Harman does not implement at this time, however.

AES50 * AVIOM A-NET * RIEDEL ROCKNET / MEDIORNET

These technologies employ layer 1 for their audio transport data. Devices which communicate on layer 1 do so very directly with fairly rudimentary protocols, and without much ability to translate data up to other layers. Layer 1 technologies usually require direct connection from device-to-device rather than through switches, just as with BLU link. Soundcraft offers an A-Net card for its digital console series.

QSC QLAN

QLAN is the proprietary network audio protocol employed by QSC in their Q-SYS product line. While proprietary, it incorporates a collection of open standards and binds them together into a transport solution. It is not available to other manufacturers, restricting it to use only within a QSC system. Of the options Harman supports, the closest to QLAN is Dante. They are both very similar layer 3 Ethernet transports derived from standards and can transmit up 512 channels of audio in and out of a device on a single CAT-5e cable, depending on the I/O limitations of the device. Both include their own proprietary control data. Being layer 3, QLAN does not benefit from the audio protection inherent within an AVB network. Instead it has its own mechanisms of protecting audio data. Video transport is not currently supported.

ALC NETWORX RAVENNA

Ravenna is an open, license-free technology, although not a standard as such. Developed by ALC NetworX, a subsidiary company of Lawo AG, Ravenna is targeted largely at the broadcast space. Another layer 3 technology, Ravenna also employs a collection of standardized network protocols for audio and proprietary control protocols. Unlike QLAN, it is available to third-party manufacturers. Unlike Dante, it is available for manufacturers to employ without licensing costs. As a layer 3 technology, Ravenna does not benefit from the audio protection inherent within an AVB network and includes its own mechanisms of protecting audio data. Video transport is not currently supported.

AES X192

The X192 initiative is at this time work in progress, yet its end goal is to identify commonality between current proprietary and open standard technologies and define a common interoperability mode. Manufacturers could then adopt X192 for interconnection between devices built on otherwise-incompatible transports. The initial focus is audio applications.

AKG

HUB 4000 Q [DSR 700, SR 4500, SR 4000, SST 4 via HUB 4000 Q]

BSS

Soundweb London BLU-100 – 12x8 signal processor with BLU link

Soundweb London BLU-120 – I/O expander with BLU link

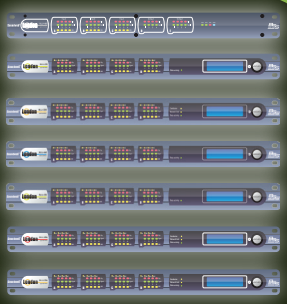
Soundweb London BLU-160 – signal processor with BLU link

Soundweb London BLU-320 – I/O expander with CobraNet and BLU link

Soundweb London BLU-800 – signal processor with CobraNet and BLU link

Soundweb London BLU-806 - Dante-compatible signal processor with BLU link

Soundweb London BLU-326 - Dante-compatible I/O expander with BLU link



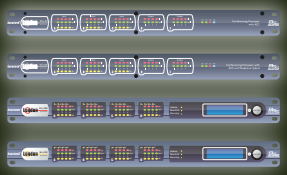
COMING SOON

Soundweb London BLU-101 - Conferencing Processor with AEC

Soundweb London BLU-102 - Conferencing Processor with AEC and Telephone Hybrid

Soundweb London BLU-805 - AVB-compatible signal processor with BLU link

Soundweb London BLU-325 - AVB-compatible I/O expander with BLU link



crown

DriveCore Install Series

CDi Series

CTs 600, CTs 1200, CTs 2000, CTs 3000 [with PIP-LITE, USP3, USP3/CN or USP4/CN installed]

CTs 4200 USP/CN, CTs 8200 USP/CN

DSi Series

I-Tech Series - discontinued

I-Tech HD Series

Macro-Tech i Series

VRACK 12000

VRACK 4x3500

USBX

XTi Series - discontinued

XTi 2 Series

dbx

DriveRack® 4800 / 4820

JBL PROFESSIONAL

VP Series [with DPAN, DPCN or DPDA installed]

VerTec® DP Series [with DP-AN, DP-CN or DP-DA installed]

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