visual engineering
LIGHTWARE

AV Over IP

White Paper

Lightware Visual Engineering

Introduction

In the conventional method, audiovisual (AV) signals have been forwarded in designated networks created for the purpose. The equipment in such a network consists mainly of video matrix switchers with a given number of input and output (I/O) ports and signal extenders forwarding the signals via high quality CAT cables or optical lines. Extenders sending signals in point-to-point configurations are called transmitters, while those receiving the signals at the far end are receivers.

In AV Over IP setups audio and video signals are usually sent through standard IT networks, though sometimes it is still recommended to build a dedicated, purpose-built network for video distribution. Devices sending signals are typically called encoders (when the transmitter actually encodes the signal), as they convert audio and video signals into data that can be streamed across a standard Ethernet network to a receiving decoder device, that converts (decodes) the received data back to audio and video signals.

Advantages of Av Over IP

Scalability

Ethernet networks can have a virtually limitless size in which any number of encoders and decoders work together in one-to-one, one-to-many or many-to-many AV configurations.

In an AV Over IP network a standard Ethernet switch replaces the conventional AV matrix switch without the limitation of a fixed I/O size. This creates a big advantage for AV Over IP systems which are in this sense infinitely expandable: as long as there are free ports available on the central Ethernet switch used, further devices can be added to the network.

Asymmetric Setup

The number of input and output 'ports' of the virtual matrix environment can be freely configured, so it is possible to create systems which e.g. have a lot of devices on the output side, while only a very few on the input.

Cost Saving

There is only need for a single cable installation which minimizes costs and reduces the complexity of dedicated cable grids for AV signals. AV signals are basically transferred as data packets, just like other network traffic, without being affected by interference caused by other nearby cables.

By employing quality AV Over IP solutions, companies can save on related infrastructure spending. While traditional AV switches might cost tens of thousands of dollars, the AV-Over-IP solution can be performed using simple Ethernet switches, requiring only a fraction of the cost.

Longer Available Distances

Compared to circuit-switched AV or HDBaseT™ connections, Ethernet based networks are more easily expandable and can exceed 100m, with all of the same management tools, permissions for stream access, and security protocols as computer data.

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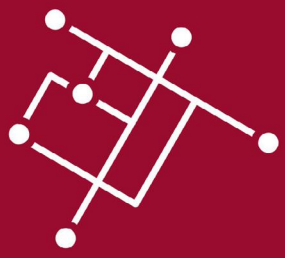
6 Advantages of Implementing AV Over IP

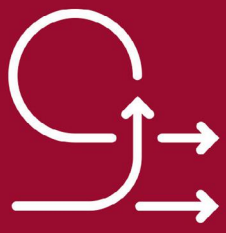


Point-to-Multipoint Content Distribution

Enhanced Resolution and Image Quality

High Quality, Low Bandwidth

Reduced Implementation Costs



Scalability and Flexibility

Long-Term Cost Effectiveness

Challenges to Overcome in an AV Over IP System

Users today expect to be able to send HD & 4K/UHD video retaining the image quality of an HDMI or HDBaseT™ video system. In order to do so, the HDMI bandwidth has increased to 18 Gbps with the release of HDMI 2.0 standards.

Typical network types are 1 Gb and 10 Gb Ethernet, of which the latter is more expensive. Neither of these network types have enough bandwidth for a 4K/UHD HDR video streams, so AV Over IP solutions must compress the quantity of data to be streamed to fit the bandwidth available. To perform the compression process some processing time is needed, which may noticeably delay the video: this phenomenon is commonly referred to as latency. The end result can either be lossless, without degradation of the image, or it can be lossy – but that usually means hardly noticeable artifacts in the video quality for most users. Video delays with respect to audio can be very disturbing, so even small amounts of video latency is intolerable, so in most systems the audio signals are usually time-coded, to sync with the delay of the video signal.

If heavy compression is used, then data is reduced to occupy the smallest possible bandwidth but the resulting video has the lowest quality and the longest latency. If the compression is lighter, then more bandwidth is needed, while quality is better and latency remains minimal.

AV Over IP systems running on 1 Gb Ethernet networks must use lossy compression for 4K/UHD video, although for many applications this will be perfectly acceptable.

The task of finding the optimal compression ratio while also retaining quality is much easier in case of smaller resolutions. Also, with the newest HDMI, DVI or SDI transmission standards it has become easier to compress efficiently as compared to analogue signals. With a compression algorithm such as the H.264 standard, the bandwidth needed for 1080p quality transmissions can be performed at 10-20 Mbits/sec, which is less than 1 percent of the bandwidth of the original signal.

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Network Speeds

1 Gb Ethernet Network

Suitable for lighter video and lossy compression codecs, like videos in Full HD, 4K/UHD@30Hz 4:4:4 or 4K/UHD with 4.2.0 color space.

Low-bandwidth codecs, like H.264, H.265, VC-2 or similar others work well in most 1 Gb Ethernet environments, even allowing multiple streams per link. Of course latency can easily reach half a second of delay making it great for long-distance or for applications not requiring interactivity.

Lightware designed and developed the VINX encoder/decoder pair for 1 Gb Ethernet networks, providing 4K@30 Hz and Full HD video signal extension with hardly noticeable latency and proprietary Lightware technologies inside, also including a 'video wall wizard', which makes installing and adjusting a video wall to be an unparalleled and unprecedented quick and easy process. This product is also highly recommended for digital signage projects.

Learn more about the VINX devices here:

VINX-120-HDMI-ENC

VINX-110-HDMI-DEC

VINX
VIDEO NETWORK EXTENDER

10 Gb Ethernet Network

Suitable for Full 4K/UHD HDR video with the use of lossless compression codecs, ideal for pro AV applications, low latency is great for either in-room or long distance applications, where interactivity is not a primary concern.

10 Gb Ethernet networks are built based on quality CAT cables, but for longer distances fiber- optic cables are used. Ten or even more low-bandwidth streams can be run per 10 Gb link between networks ensuring great flexibility and scalability for AV distribution.

Exploiting all possibilities of a 10 Gb Ethernet network and offering further, future-proof signal distribution options for even bigger network speeds, Lightware developed the UBEX optical extender line. The abundance of novel features of this product include selectable compression rates, user-exchangeable optical modules for various network speeds and multiple streams of high quality Full 4K signal extension with only a minimal compression applied. It is also possible to use this device without compressing the signal and transfer Full 4K/UHD@60Hz 4:4:4 video over two 10Gb optical lines employing the so-called link aggregation method.

Learn more about the UBEX devices here:

UBEX-PRO20-HDMI-F100

UBEX
ULTRA BANDWIDTH EXTENDER

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Selecting the Optimal Managed Switch

One of the most important decisions when installing an AV Over IP system is the selection of the managed gigabit Ethernet switch that will be the heart of the system in both 1 Gb and 10 Gb systems as well. The Lightware sales and support team can provide help and recommendations for selecting the optimal Ethernet switch to use.

Setting Up the Network for AV Over IP

Learn more about selecting and setting up the optimal network for the VINX extenders and their various operation modes in this white paper:

VINX GIGABIT NETWORK ROUTER REQUIREMENTS

For more information on Lightware products and further expert advice on available systems visit the Lightware website or contact a Lightware representative at www.lightware.com.

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