A-Net v. Ethernet:

Networking Designed for Audio

The world of professional audio is increasingly digital. Virtually all the devices used in live and studio sound—mixers, signal processors, recorders, even microphones—can now operate in the digital domain. In this digital world, analog signal transport seems ever more cumbersome, inflexible, and limiting.

And yet there are still an awful lot of analog snakes out there, in critical applications, carrying multi-channel audio on copper wire that's bulky, inflexible, and prone to ground loops and induced hum. Many audio professionals have—perhaps rightly—been skeptical of the ability of digital solutions, most of which are based directly on the Ethernet protocol, to deliver high-quality, low-latency multi-channel audio feeds with the reliability and fidelity of an analog wire. However, Aviom's A-Net® technology now makes the goal of replacing all that analog infrastructure with digital data, carried on Cat-5e or fiber optic cables, a practical and attractive reality.

LIMITATIONS OF ETHERNET

Ethernet is a robust, time-tested communication technology. Electrically, Ethernet provides a fast, stable data pipe, well suited for carrying large amounts of information reliably. However, the data management layers of the Ethernet protocol were designed for general purpose network traffic, such as file sharing, print jobs, etc. Ethernet traffic is carried in a series of switched packets, each of which must be transmitted, routed, acknowledged, reassembled, and possibly retransmitted in the event of a collision.

Though the timing of these packets and the order in which they are received is not particularly critical in a generalized network environment, a digital audio network requires absolute timing accuracy and reliable reception of data. Ethernet-based audio transport protocols are burdened with the overhead and timing issues related to switched-packet networking.

THE PERFORMANCE ADVANTAGE OF STREAMING

Though A-Net uses the same Cat-5e cables as Ethernet-based protocols to transmit audio, it does so in a much more efficient and deterministic manner. That's because A-Net was designed from the ground up for carrying audio, not grafted onto an existing protocol that was designed for generalized network traffic.

A-Net is built on the "physical" layer of Ethernet, but it strips away all the data management layers that add overhead and introduce timing instability. Unlike Ethernet data packets, A-Net packets are streamed through the system without any switching anywhere. A-Net uses merger hub devices rather than switches, which allows for parallel network topologies with more efficient network operation, faster data throughput, and better performance.

Eliminating the data handling layers of Ethernet also means cable runs can be extended. While the maximum distance between Ethernet devices is 100m/330 ft, A-Net cable runs extend up to 150m/500 ft on Cat-5e. Each A-Net device will refresh the signal for an additional 150m. This difference can be crucial when connecting distant locations in a studio or live venue.

BETTER CLOCK MANAGEMENT

Pro64® A-Net offers more flexible clocking options than Ethernet-based variants. Any device on the network can be set as the audio clock master, or the system can be synced to an external master clock from any point in the network. Thus, a Pro64 A-Net system can smoothly operate with other digital devices, allowing applications such as synchronizing to a digital console or a facility's house clock.

Traditionally, digital components require an exact sample rate, so building a complex network of interconnected devices is problematic. No Ethernet-based system offers the sample rate capture range of A-Net.

Variable sample rate support allows an A-Net network to sync to a clock source whose sample rate is not exactly the nominal value, or is not particularly stable, such as a digital tape deck or a SMPTE video desk.

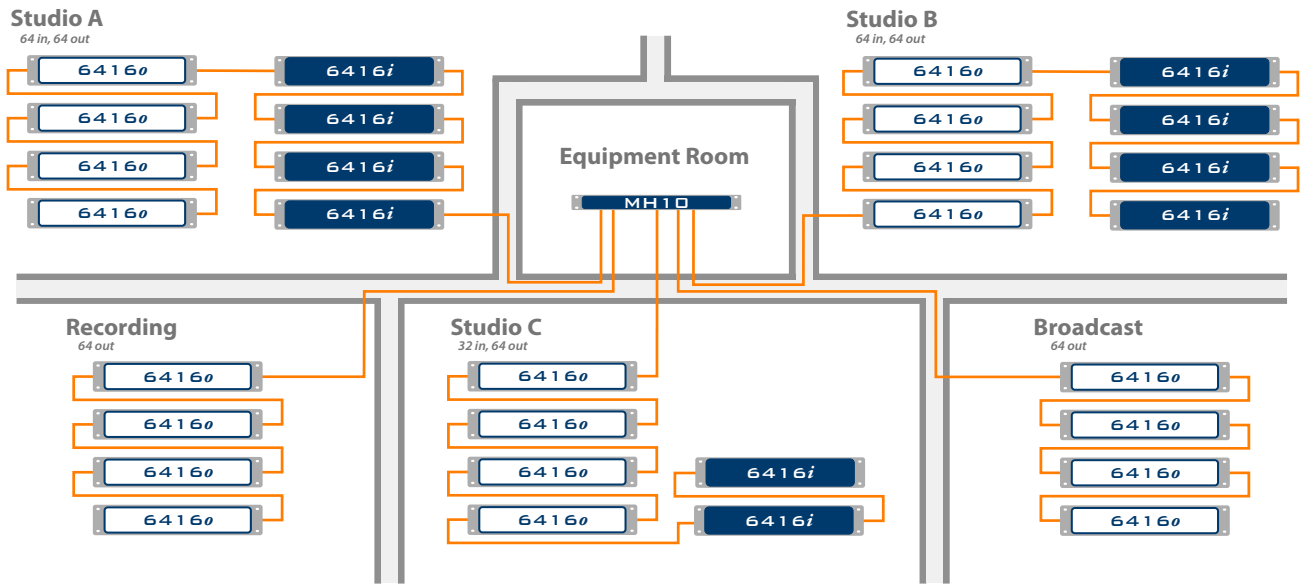
JITTER, WANDER, AND LATENCY

Perhaps the three most significant technical issues which must be addressed in any digital audio system are jitter, wander, and latency. Jitter is the result of small variations in the clock rate as the devices on the network attempt to

PRO64 A-NET SUPPORTED SAMPLE RATES

Mode	Nominal	Min	Max
1x	44.1kHz	39.7kHz	52kHz
	48kHz		
2x	88.2kHz	79.4kHz	104kHz
	96kHz		
4x	176.4kHz	158.8kHz	208kHz
	192kHz		

Figure 1. **Pro64 A-Net supports three ranges of variable sample rates, without requiring sample rate converters.**



Everything Everywhere. **Up to 64 channels, from any combination of the three studios, can be inserted into the network. All channels are available for output at every location shown here. Network topology has no impact on availability of channels; modules can be connected in the most convenient manner.**

stay in sync with the master clock, and it introduces audio distortion and noise. Wander is low frequency jitter, caused by the accumulation of jitter as clock information is retransmitted from device to device. And latency is the time delay between the audio input at one device and the audio output at another.

In Ethernet-based audio networks, since timing information is sent along with other switched packets on the network, there is inherently more variability in the arrival of that information to each device. A-Net, however, isn't limited by the constraints of Ethernet, so its design can be optimized to deliver lower jitter and wander than any Ethernet-based system, without imposing constraints on topology or clocking.

UNLIMITED TOPOLOGIES WITH NO RESTRICTIONS

Ethernet-based audio networks can impose significant restrictions on both the design of the network and the ability of devices to communicate bidirectionally depending on topology. Some specify a relatively low maximum number of network "hops" before performance is compromised. Some allow full bidirectional communication as long as devices are daisy-chained, but are limited to a downstream-only model once units are connected in a parallel (star) topology through network switches or hubs.

A-Net imposes no such restrictions. Any audio input at any Pro64 A-Net device can be received by any other device on the network, regardless of whether the devices are connected in serial or parallel, or any combination thereof, and regardless of how many devices are connected to the network. Pro64 A-Net is always bidirectional.

MORE THAN AUDIO

Through its innovative Virtual Data Cable™ (VDC™) technology, Pro64 A-Net has built-in, dedicated bandwidth for 14 channels of non-audio control data. These data streams are always available to carry MIDI, RS-232/422, or GPIO (depending on the I/O complement of a given device), but unlike in some Ethernet-based systems, they never compete with the audio channels for network resources. And any serial data streams introduced into the A-Net network benefit from the flexible routing capabilities (any input is available at any output) and increased cable lengths associated with A-Net.

THE RIGHT TOOL FOR THE JOB

Audio professionals know that a dedicated tool designed to do a specific job will always out-perform a general-purpose solution pieced together from off-the-shelf parts. When it comes to transmitting and networking high quality multi-channel digital audio, A-Net is the right tool for the job.

With A-Net, Aviom has stripped Ethernet of all its extraneous and bandwidth-wasting overhead to produce an audio transmission protocol that reproduces superb sound from end to end with lower latency, less jitter, and less wander than existing Ethernet-based solutions. A-Net offers the simplicity and fidelity of analog, with the flexibility, power, and performance of a true digital audio network.