Radio World
The Newspaper for Radio Managers and Engineers
REPRINTED FROM SEPTEMBER 1, 2005 WWW.RWONLINE.COM

Building and Running a TCP/IP Audio Plant

by Tom Vernon

The speed with which the digital audio plant has matured is amazing. A decade ago, a few pioneers interconnected digital consoles, recorders, codecs and hybrids using AES3 and S/PDIF cable, and the first all-digital broadcast studios were up and running.

Progress has been swift, and today's digital audio infrastructure bears virtually no resemblance to that of the mid-1990s.

While the term IP audio generally is used to describe network-based audio, many vendors offer both Ethernet solutions for low-latency studio applications as well as IP solutions for distribution and routing of audio where slight delays are not a concern. Typical components include a PC-based mix engine, audio terminals to connect legacy gear and an Ethernet switch. The entire system is usually interconnected with Cat-6 cable or fiber.

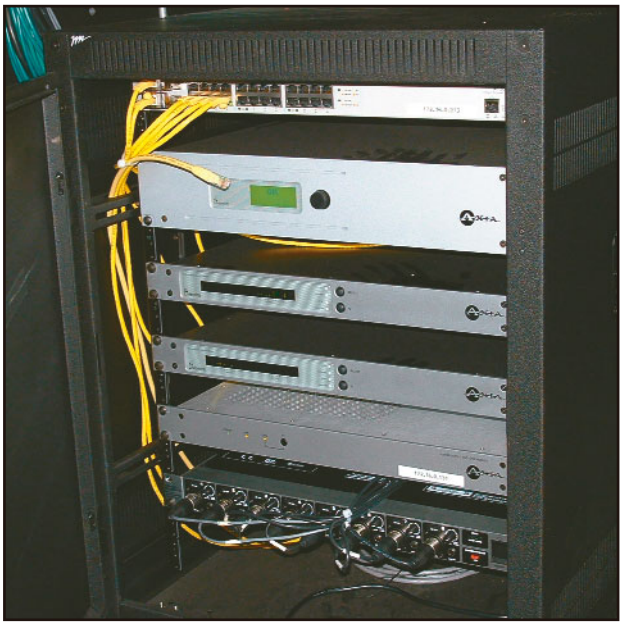
Supporters of this approach say an IP audio plant has many advantages over a conventional TDM digital installation, particularly for those contemplating HD Radio.

Mike Dosch, president of Axia Audio, said, "Most stations that are going HD are already digital, and have RDS. What is uncertain is where HD is going. Surround sound is a definite possibility. With an IP audio system, the differences in setup between stereo and surround are minimal. A traditional TDM system doesn't have this flexibility."

Dosch said an IP audio system can be installed one studio at a time, while TDM requires the entire plant to be converted at once, usually a significant expense. A greatly simplified wiring infrastructure with IP or Ethernet audio reduces cabling and labor costs.

Frank Seidel, communications manager for Digigram, said, "The biggest obstacle to widespread adoption of IP or Ethernet-based systems is the large installed base of TDM users, who have a major investment in these plants." Seidel predicts that the advent of surround sound will be the driving force for the acceptance of this new technology.

Users of IP audio plants get a break on equipment costs as well. While a typical TDM router can cost about $50,000, the necessary Ethernet switch sells for about $750.



Axia system in place at NewCap Radio installation in Edmonton, Alberta.

By no means do TDM supporters take all this lying down.

"TDM systems are more secure than IP audio," says Brad Harrison, director of international sales for Wheatstone. "IP systems are not proven 100-percent secure from viruses. IP systems have bandwidth management issues. IP systems require a whole layer of management that is not necessary for TDM systems."

'Buy in'

Further, if surround sound is a driving force, confusion over standards may be a restraining force.

Some companies have standardized approaches to IP audio distribution using the Internet RTP (Real Time Protocol) format, and others have proprietary schemes. While it's not always possible to connect different vendors' equipment directly together through the network, interfacing through PC soundcards is usually a practical solution.

Stephen Turner, vice president of AudioScience, said the lack of "buy in" by other equipment manufacturers could also be a hindrance.

"It would be a huge plus if consoles, processors, codecs and other studio gear had a standardized Ethernet port on the back so that users could mix and match network-capable gear easily as AES3 or analog audio equipment."

While some interconnection issues are still in limbo, several IP plants have been completed. NewCap Radio of Edmonton in Alberta, Canada recently switched over to a studio buildout with IP audio technology. Three local stations, a satellite head end and associated production facil-

ities were involved in a move to the West Edmonton Mall. The new 26,000 square foot facility uses Axia Audio components, including five control surfaces and 36 nodes.

Bruce Wilkinson, vice president of engineering for Pippin Technical, supervised the installation and noted some of the savings from this type of studio build.

"There are lots of data cabling companies who will pull and certify Ethernet cable quickly and inexpensively. The same crew who pulled the data cable for the offices also did the Ethernet in the studios. This saved considerable time and money, and allowed us to concentrate on the rest of the job."

While IP audio can coexist on the same network as VoIP phones and conventional network traffic, Wilkinson used separate networks in the Edmonton installation. One PC serves as the gateway between the networks, allowing PC audio workstations to connect with the studio system.

The Axia network extends to the penthouse atop the mall's 12-story hotel, allowing both program feeds from three stations along with satellite audio to be routed to the Moseley digital STL and satellite uplinks respectively. It also provides audio feeds back to the studios from off-air receivers.

Virtual LAN

When WBHF(AM) in Cartersville, Ga., moved studios from corporate headquarters into new facilities in a historic district, it couldn't mount its five satellite dishes on the roof.

"Since there was already fiber running the four miles between headquarters and the new station, we installed Digigram's Ether Sound ES8in and ES8out using the existing Ethernet," said Mark McKelvey, director of management information systems for Anverse Inc., which owns the station.

The Digigram ES8in takes up to eight analog audio sources and inserts them into an EtherSound network. On the other end, the ES8out converts them back into analog audio. Both units can provide bidirectional control.

The station set up a virtual LAN that dedicated a 100 MHz bandwidth on the network. The audio from the five satellite dishes travels as a stream through the system and breaks out at the studio end. Tones are sent from the studio back through the same system for remote control of the dishes. The five audio feeds coexist on the fiber with traditional network traffic between corporate headquarters and the WBHF studios.

"The alternative to this Ethernet solution," said McKelvey, "was spending about $150 per month each for five dedicated lines from the phone company."

While the physical wiring of an IP audio plant is pitched as a big benefit compared to that of a traditional analog or digital installation, it has hidden complexities, and its coming can be a shock to an engineering staff that is unprepared.

Tom Ray, vice president/corporate director of engineering for Buckley Broadcasting's WOR in New York, recently supervised the installation of an IP studio buildout.

Proper prep

"On one hand it can be scary, but you need to look on it as a new challenge," he said.

Success depends to a large degree on engineers getting the proper training and skills beforehand. A good jumping-off point, according to Ray, is to study the Certified Broadcast Network Technologist exam questions in the CERT Preview CD, available from the SBE. Much of the material is relevant to the TCP/IP audio plant, and it wouldn't hurt to take the exam to become certified.

For those contemplating an Axia installation, understanding the basics of the Linux operating system is valuable. "When you're on the phone with the Axia tech support guys, things go a lot faster if you know the Linux commands," Ray said.

Another thing to learn and understand is the wiring convention for Ethernet cables. Standards specify specific pairs of wires in the cable that must be used for transmitting and receiving data. Ray notes that if the wires are not correctly mapped to the pinout on the connector specified by the standard, the cable might generate errors due to noise or cross-talk.

He said it's also good to understand the workings of networking components. "You may be asked by management to explain why you're using the more expensive Ethernet switch in an IP plant, when inexpensive hubs are readily available at the discount office supply store."

Documenting the TCP/IP plant has some unusual twists. The traditional cable runlists and flow diagrams are still used; but, Ray said, that isn't enough. "It's important to have a listing of what is on each node, so if it fails it can easily be recreated. To do that, we've taken screen shots of the node listings and stored them on CDs."

The Networked Workbench

Your trusted DVM will be of limited use when it comes to troubleshooting a delinquent IP network. This kind of plant upgrade requires different test equipment and methodologies than those that are used in a traditional analog or digital installation.

WOR's Tom Ray recommends that users start with a laptop containing both a network (TCP/IP) port and a COM port, which can be difficult to find on today's portable computers. The TCP port allows users to access the system's Web pages for configuration, logging and troubleshooting. The COM port permits access to the system when there are failures that make TCP/IP access impossible.

The management software that comes with Ethernet routers and the IP audio gear is valuable in logging system failures and spotting bottlenecks.

A network cable analyzer such as the $5,995 Fluke DSP-4000 or $125 B+K Precision 240A is essential for locating cables that are noisy, have incorrect pinouts or are otherwise bad.

Network analysis software installed on your laptop enables you to visualize the data flow through the system, check security, and run housekeeping chores. Among the popular programs are shareware such as IP-Tools and NetworkActiv Scanner.

Even though this type of audio plant is basically an Ethernet network, don't toss your conventional audio test gear. It's still valuable for setting levels and testing analog and digital throughput on recorders and other source equipment.

— Tom Vernon