AV Technology's Guide to Networked AV

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GUIDE TO NETWORKED AV

BY MARK MAYFIELD, EDITOR, AVTechnology

Ten years ago, you would rarely see the words "AV" and "network" used in the same sentence, let alone linked together. Today, modern networking concepts and technologies are common in pro audio and AV applications.


Photo courtesy of IVCi

Of course, any discussion of networking connotes computer and information technology, but communication networks have been around since the early days of telegraphy in the early 18th century. Even earlier, if you consider that IT networks are conceptually the same as early man's smoke or beacon signaling methods. All of these networks use symbolic representation of content and two-way transmission to communicate information across multiple nodes. The main improvements have been in speed and quality (or integrity) of data transfer.

Any discussion of AV networking should begin with a clarification of the definition and scope of the topic. At its core, a network is nothing more than a group of components that share data. Yet "AV networking" can have many meanings depending on your perspective. It may mean something different if you have a "bias" toward audio, video, or IT, and whether you're an equipment manufacturer or technology user. Fundamentally, an AV network makes it possible to monitor, control, and transmit content. It can do one or more of these things, and still be considered a "network," And it can monitor/control/transmit content from one (or many) sources to one (or many) destinations. The content can be primarily audio, video, or both (AV).

In this *Guide to Networked AV,* we'll consider AV networks to include those that deal with the transmission of audio or video content (or both types), along with some means of monitoring and controlling it across an interconnected system of components. We'll present several vertical market perspectives, as well as a technology overview from both the audio and video "biases." We believe that this will provide a fresh, balanced look at how today's tools have improved on one of the oldest communications technologies known to man.

NETWORKED AUDIO

A networked audio system is a collection of components designed to accept audio input signals, process these signals, and make them available throughout the system in digital format via some sort of high-speed interconnects.

Much of the audio equipment used today is digital inside, but the most common way of distributing audio remains as analog signals over point-to-point networks. However, digital offers clear advantages over analog distribution. Multiple audio signals can be sent over a single connection, digital signals are less prone to attenuation and noise, and the degradation and delay that multiple A/D and D/A conversions introduce can be minimized or avoided if the distribution, processing, and mixing of audio signals is performed in the digital domain and conversion only takes place at the edge of the network.

For audio signal transport, there are at least four digital audio networking technologies vying for dominance.

One of the earliest approaches to digital audio signal transport was developed by Peak Audio (now Cirrus Logic) in the mid-1990s. **CobraNet** is a combination of software, hardware, and network protocols that allow distribution of many channels of real-time, high-quality digital audio over an Ethernet network. CobraNet is supported for repeater and switched Ethernet variants. On repeater networks, CobraNet eliminates collisions and allows full bandwidth utilization of the network. CobraNet uses standard Ethernet packets and network infrastructure (controllers, hubs, repeaters, switches, cabling, etc.). CobraNet delivers audio in standard Ethernet packets over 100Mbit Fast Ethernet. Switches, hubs, media converters, and other gear that operate in compliance with the IEEE 802.3u specification for Fast Ethernet will work with CobraNet. According the company, CobraNet devices can coexist on an existing LAN with office PCs as long as it's a switched network.

Dante is a new digital audio networking technology from Audinate that is compatible with standard Internet Protocols (not just Ethernet) without compromising performance. Sample-accurate synchronization and low latency allows Dante to be used in live audio applications.

Audinate's "Zen" technology builds on and extends "zero configuration" network techniques into the application domain to simplify network set-up. There's no need to allocate IP addresses, no need to set up and manage DNS or DHCP servers before the network will operate, and equipment in the network becomes aware of the audio capabilities of other nodes in the network. Like CobraNet, Dante allows audio channels to co-exist with other data traffic.

EtherSound is an open standard for networking digital audio using off-the-shelf Ethernet components. Fully compliant with IEEE 802.3, EtherSound is a deterministic network protocol with high data capacity at mixed sample rates and powerful control functions. EtherSound's latency is stable and easily calculated: the point-to-point transmission time between an audio input and an audio output in an EtherSound network is six samples (125 microseconds at 48 kHz), independent of the number of channels transmitted. As Ethernet standards evolve, EtherSound is able to keep pace, since the Network and Data Link layers are implemented via FPGA's (Field Programmable Gate Arrays). EtherSound networks can accommodate more than 60,000 networked audio devices in daisy-chain or star architectures, or a combination of both. All daisy-chained devices can send and receive all channels concurrently.

Photo courtesy of L-Acoustics

A-Net is Aviom's proprietary audio distribution and networking technology. A-Net is based on the physical layer of Ethernet, so it uses familiar CAT-5e cables and RJ-45 connectors. Unlike Ethernet, however, A-Net is designed specifically for the unique demands of data-intensive streaming audio. Because of this, A-Net claims several benefits over Ethernet-based approaches to distributing audio digitally, including reduced latency, longer cable runs, and improved clock performance, without sample rate converters or restrictions on system layout. To date, there are seven manufacturing partners who offer A-Net compatibility with their products.

VIDEO ON THE NETWORK

BY PHIL HIPPENSTEEL

There are many applications of network video in the corporate world. Today, corporate IT is often responsible for the transport of training videos. The IT network also frequently needs to carry executive presentations that are considered essential to communications strategies.

Unfortunately, not all forms of video are alike, nor do they have the same impact on the network. The type of video transferred across the Internet is often based on TCP (Transmission Control Protocol) rather than UDP (User Datagram Protocol). TCP was created primarily to transfer large bulk data files, so it attempts to consume as much bandwidth as the connection makes available. It is likely to have a big impact on other applications that share network resources.

Videoconferencing is now commonly transported over IP, often in the standard MPEG transport stream. Such a transport stream is becoming the universal format for most forms of video. Unfortunately, many of your network troubleshooting tools may not work here, because the tools look for a "call set-up" procedure. If they see it as H.323 or SIP, they often assume the stream is a voice stream rather than MPEG video.

Unlike digital audio networks, conventional video over IP follows standards closely, and can most easily be dealt with in an IP network. And the other forms of video are beginning to use MPEG transport stream format.

One of the differences between how video is delivered on networks today versus ten years ago relates to how it analyzed and managed. In an analog video world, evidence of problems included ghosting or scattered interference patterns. In a digital non-IP world, the signal is either perfect, or not received at all. But with video over IP transport, the most common problem is "tiling." Small rectangular parts of the screen are distorted due to "packet loss."

When the encoder receives the video input, it separates the video portion from the audio portion. To prepare the video for transport, it takes a single frame (1/30 second) and compresses it. Rectangular blocks of pixels are compressed separately. The resulting data becomes the payload of an MPEG packet. Subsequent MPEG packets are computed or partially computed using that first block. Seven sequential MPEG packets become the payload of one IP packet, and the encoder sends it onto the network. If the network drops any of the IP packets, the portion of the recreated frame will be distorted or black.

Video requires large amounts or bandwidth. For example, standard definition video encoded as MPEG2 will need 3 to 5 Mb/s. High definition (HD) will take more — much more. Once the MPEG payload is inserted, three or four packet headers are added. When the packets are completed, they are typically about 1,350 bytes each.

Since these packets have uniform size, they will be handled somewhat efficiently by switches and routers. Play out should be smooth, unless you mix in standard data traffic, like Internet applications, which are mostly TCP-based with variable length packets. This can wreak havoc. When small packets need to get out of a switch before a video packet, there is little delay. However, when a large packet is queued in front of a video packet, there is much more delay. This introduces network jitter, and it forces the STB to compensate for the unpredictable delivery times, causing packet loss and, as a result, tiling.

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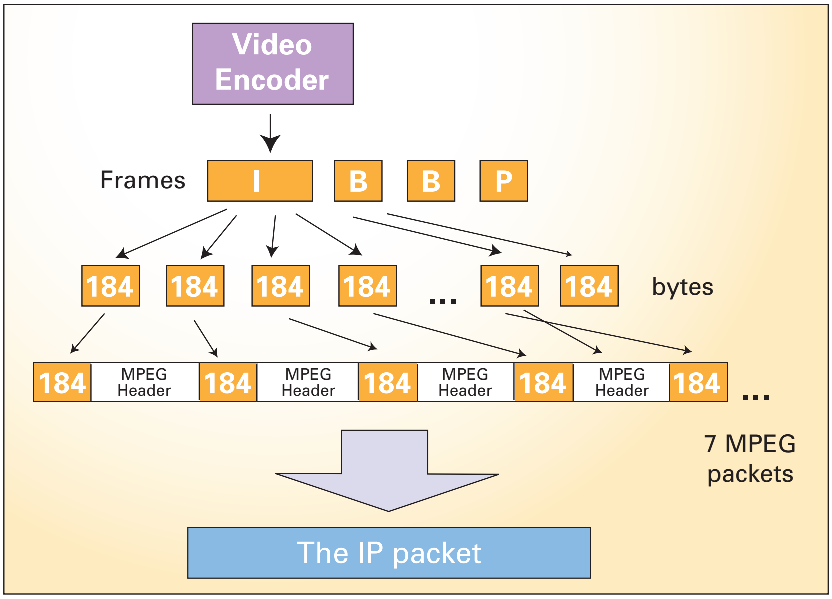


The video encoder typically compresses each frame of video (1/30th of a second) and compresses it into an I, B, or P payload frame. Then it attaches a 4-byte header. Seven of these MPEG packets become the payload for the IP packet.

MARKET PERSPECTIVES

THE GOVERNMENT VIEW

By Gary L. Hall

The U.S. federal government is moving toward network AV adoption through high-level directives from entities such as the Office of Management and Budget (OMB) and the Department of Defense (DoD). These directives are intended to help break down barriers to collaboration and interoperability.

Despite initial progress, barriers still exist. Key barriers include bandwidth limitations, cultural resistance, stovepiped networks, security concerns, budget constraints, difficulty enabling multicasting, and the lack of qualified AV network managers and technicians.

Many federal IT managers still regard AV technologies as risks to their network stability. Their number one complaint is the amount of bandwidth required by AV. Proper QoS provisioning and the use of network performance monitoring tools can overcome many of these concerns. The second major concern is the complexity of properly integrating and configuring network AV components — which is where knowledgeable AV/IT personnel will help.

Agencies are converging formerly stovepiped AV networks onto enterprise networks to facilitate interoperability between room-based videoconferencing systems and new desktop units, as well as streaming media and other collaboration technologies. The emergence of unified communications as well as Web 2.0 and IPv6 trends has framed AV technologies in terms that are familiar and understandable to IT managers, which will help promote widespread adoption.

THE CORPORATE VIEW

By Joey D'Angelo

There are many ways that network technology is drastically changing the AV industry as we know it. We all know about the benefits associated with the application of networks to control systems, schedule rooms, and manage assets, but there are some less obvious benefits that can save money on large projects.

Recently, while engineering a large museum-type AV project, I found myself in a budgetary pinch. This project contained no fewer then 47 edge-blended projected images. In the past we would have connected each projector to a large-scale matrix switcher. The problem was that this matrix switcher would have cost about $500,000, almost 1/3 of our $1.4 million total budget. But by using the capability of networked AV components, we were able to come in under budget and deliver a higher degree of flexibility.

We replaced the large matrix switcher with small, networked MPEG video players at each projector. Then we put each MPEG player on their own small network using relatively inexpensive off-the-shelf hubs. Lastly, we used a simple software application to control the content at each projector. The result was the same capability of a big matrix switcher at a fraction of the cost with far fewer potential points of failure.

If one were to take this networked content distribution scheme a few years into the future, it would probably be no surprise to see all projectors and flat panel displays with network cards and built-in players for all sorts of video content. It's only a matter of time before network AV becomes the norm, not the exception.

THE EDUCATION VIEW

By Steve Cunningham

Network AV in education today is used primarily for on-demand delivery of multimedia course materials to students. Recent initiatives in education include efforts to create a "learner-centric" environment where students can study on irregular schedules and working adults can retrain themselves while holding down full time jobs. Streaming course materials are considered key to creating this environment.

Network AV is a minimum requirement for these initiatives as an integral component of Course Management Systems (CMS) like Blackboard and Moodle. Today the CMS has filtered down from post-secondary schools to secondary and even primary schools, driving the demand for online teaching materials that range from basic audio and video podcasts, to master classes conducted via live videoconference.

Other applications for network AV include real-time videoconferencing, widely used for collaborative research and for teaching between remote campuses and different universities. It is also vital to libraries, as we digitize their collections and make them available to students online.

Rather than invest in separate network AV infrastructures, many schools are content to use their existing networks for delivering multiple forms of streaming media. Where the network infrastructure cannot handle large streaming files, it's feasible to adapt by compressing the material and breaking it up into smaller chunks. One notable exception is Internet2, a consortium of 207 universities who have each implemented a closed high-speed network for research and experimentation purposes.

![infoComm08 INFORMATION COMMUNICATIONS MARKETPLACE]

infoComm08
INFORMATION COMMUNICATIONS MARKETPLACE

Exhibitors at InfoComm08 Whose Products Enable Networked AV

NORTH HALL

AUDIO & VIDEO CONFERENCING EQUIPMENT

Hall Research Technologies	N6629
Polycom	N6019
Smart Technologies	N5817

CONTROL SYSTEMS & NETWORKING

Applied Technical Systems	N6747
Aurora Multimedia	N6429
AV Stumpfl	N6368
Avocent	N6925
Broadcast Pix	N6517
Calypso Control Systems	N6071
Christie Digital Systems	N5427
Crestron	N5300
D'San	N5455
Ensemble Designs	N6307
Grass Valley	N6312
Gyration	N6616
Ingram Micro	N7341
Jupiter Systems	N6063
Kramer	N5141
Magenta Research	N6362
NetStreams	N5012
"Simtrol, Inc."	N7432
SP Controls	N5031
Tightrope Media Systems	N6612
Visionary Solutions	N6756
Vity Technology	N5477

DIGITAL SIGNAGE

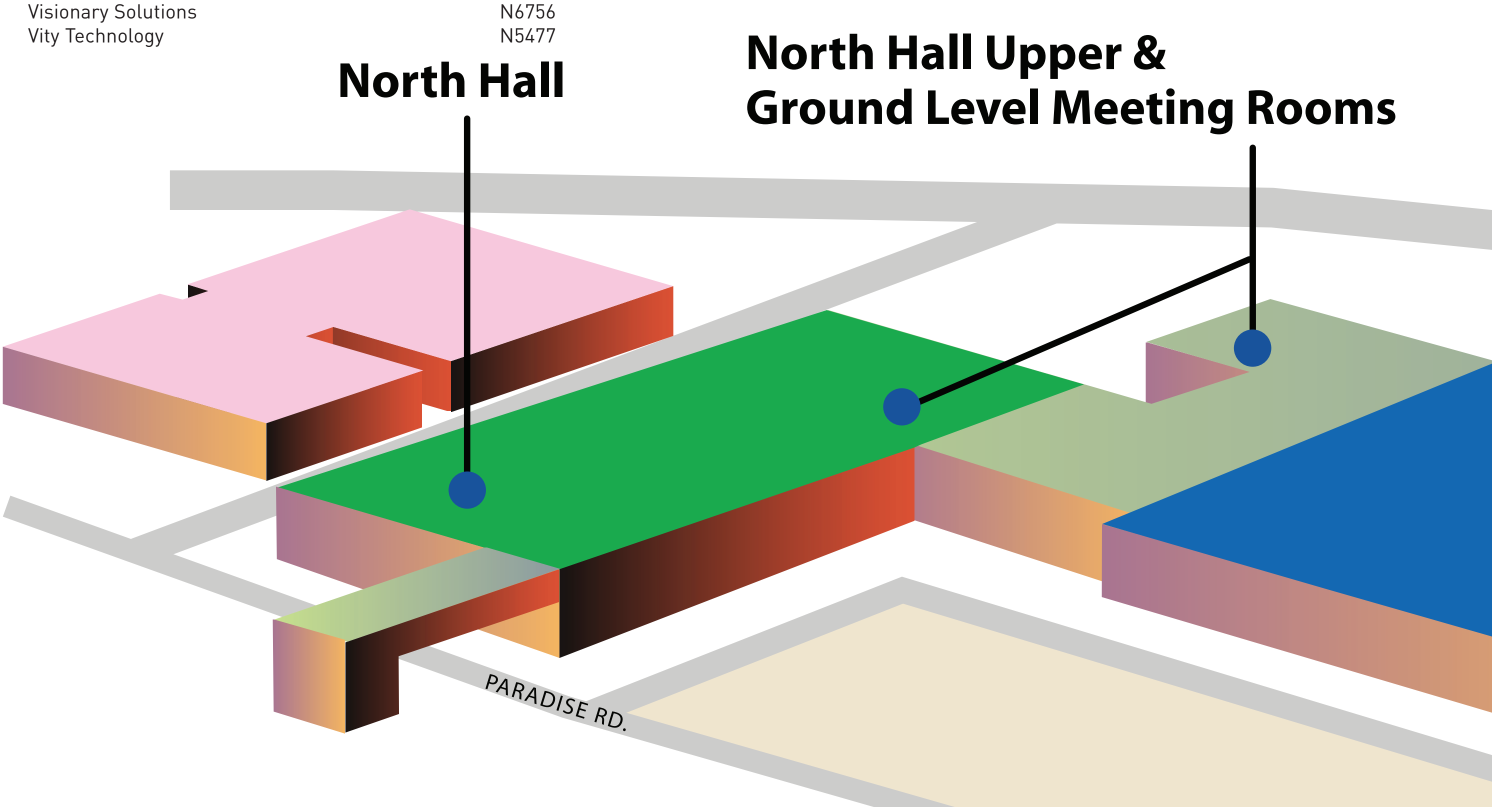
Adtec	N6825
BroadSign	N6415
Capital Networks	N7017
Chyron	N7248
MagicBox	N6724
Matrox Graphics	N6731
Omnivex	N7125
Reflect Systems	N6957
Scala	N6931
StrandVision	N7058
Wireless Ronin	N7318

IT/DATA NETWORKS

Broadata Communications	N6718
Seagate	N7355

STREAMING MEDIA & WEBCASTING

Accordent Technologies	N7041
Doremi Labs	N5351
NCast Corporation	N5773
Sonic Foundry	N5560
Technovare	N6613
Vbrick	N6841



CENTRAL HALL

CONTROL SYSTEMS & NETWORKING

Alcorn McBride	C3055
Allen & Heath	C3908
Altinex	C3348
AMX	C2902
Analog Way	C930
Ashly Audio	C4025
Atlas Sound	C4049
Aviom	C4175
Biamp Systems	**C3949**
Bosch Communications Systems	C3439
Cirrus Logic	C4178
Clear-Com	C3583
Cloud Systems	C3180
Crest Audio	C3727
Digico	C4874
Digigram	C5556
Eastern Acoustic Works	C4436
Extron	C1508
FiberPlex	C4187
For-A	C2316
Global Cache	C805
Harman Pro	C3523
Lab.gruppen	C3857
L-Acoustics	C4387
Leviton	C4115
Martin Audio	C4003
Mediatech	C3753
Meyer Sound Laboratories	C3649
NetCIRA	C3908
Opticomm	C3519
Peavey Electronics	C3727
QSC Audio	C3459
Rane	C3932
Renkus-Heinz	C4257
Symetrix	C3885
TASCAM	C3669
TOA Electronics	C4031
Wheatstone	C4169
Yamaha Commercial	C4069

AUDIO & VIDEO CONFERENCING EQUIPMENT

Aethra	C3375
Arrive	C2434
ClearOne Communications	C3739
Codian	C2975
Haivision	C2443
Lectrosonics	C3513
LifeSize Communications	C3287
Listen Technologies	C3903
Media Vision USA	C4124
Multidyne	C1926
Radvision	C3387
Revolabs	C4163
Sony	C1500
Sony	C2983
Tandberg	C3124
Telanetix	C2344
TelePresence Tech	C3165
Vaddio	C1344
Yamaha Electronics	C3280
York Telecom	C2342

DIGITAL SIGNAGE

Contemporary Research	C2301
Electrograph	C1230
Gefen	C1740
Innovative Electronic Designs	C4785
Leightronix	C2318
Rose Electronics	C2822
TV One	C2430

IT/DATA NETWORKS

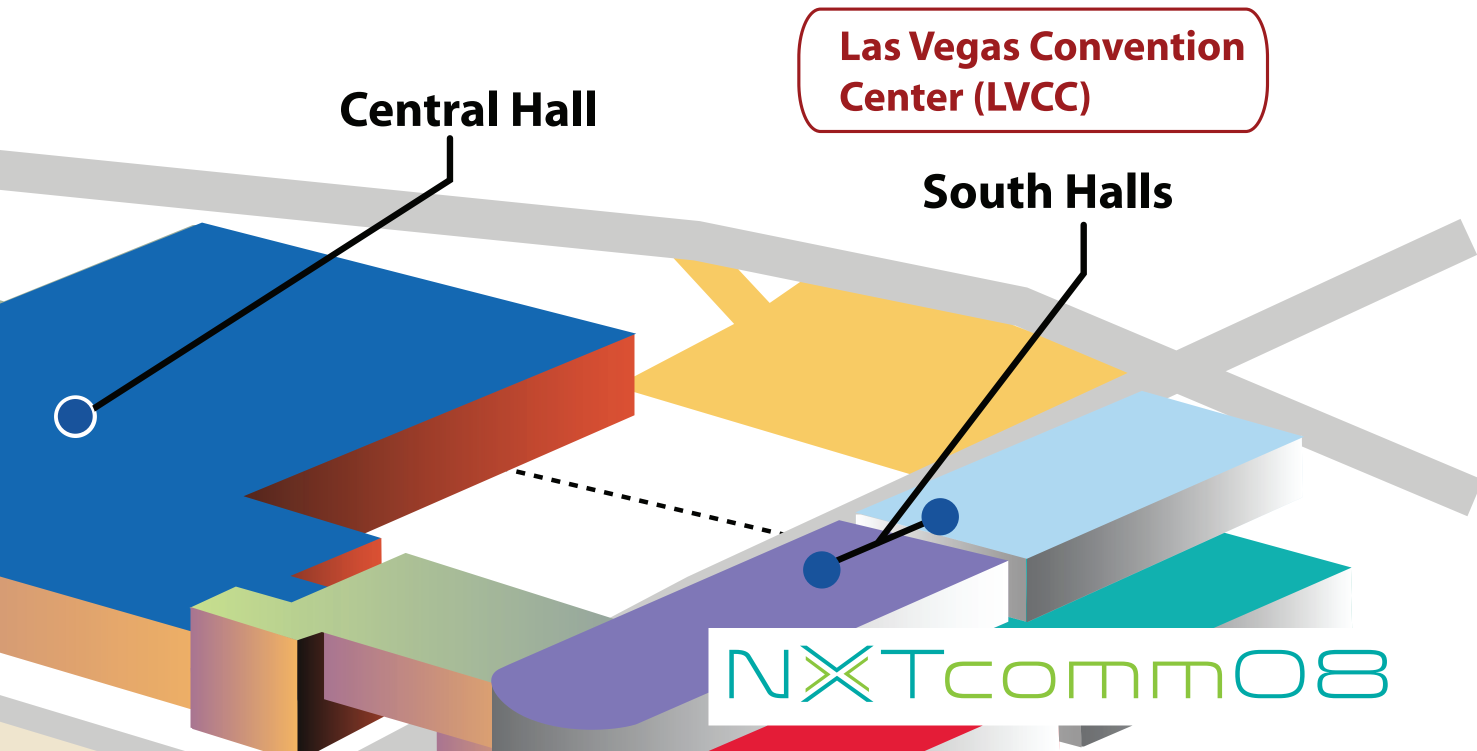
Visix	C2101

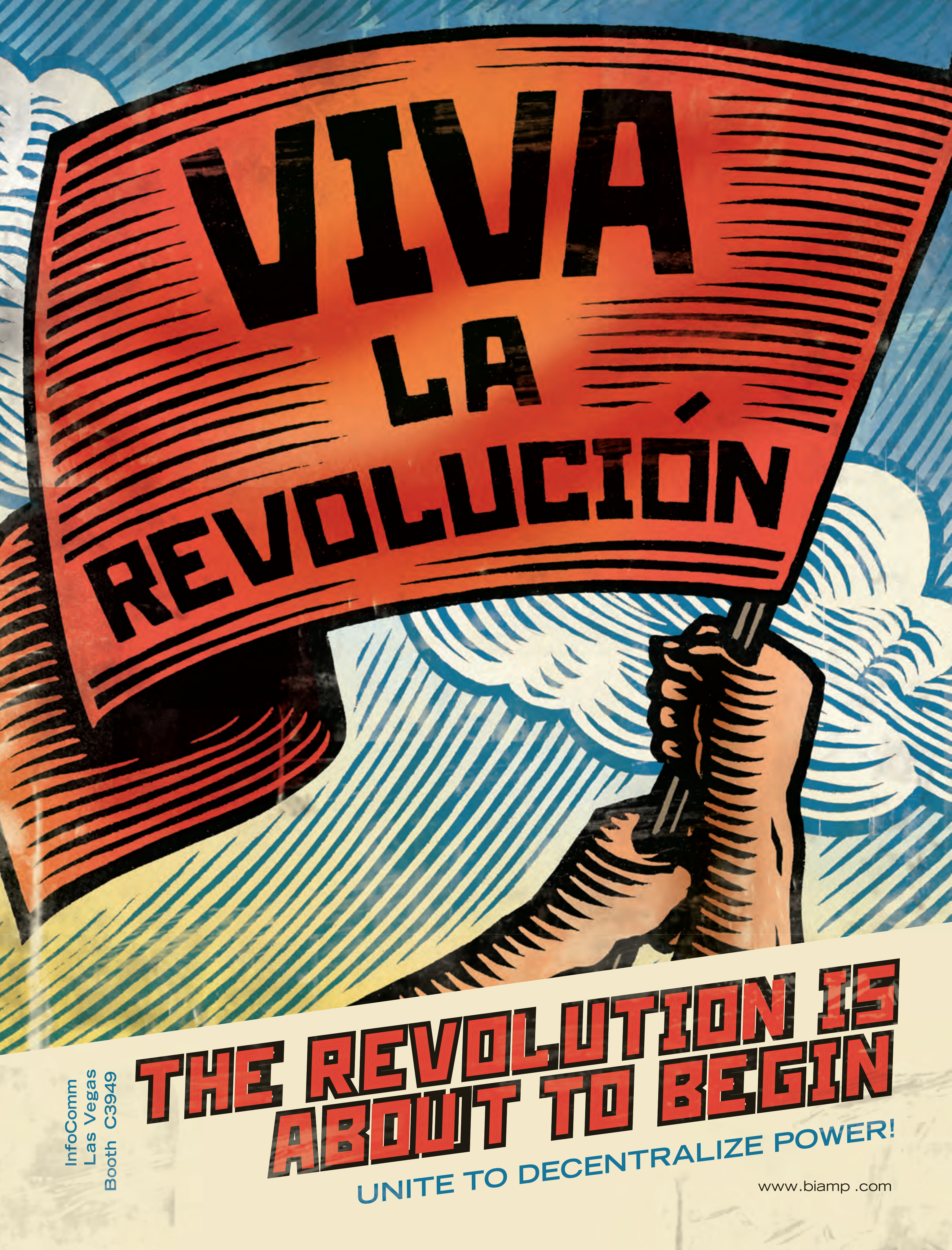
STREAMING MEDIA & WEBCASTING

MediaPointe	C3431

MEDIA RESOURCES

AVTechnology (NewBay Media)	C2026

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