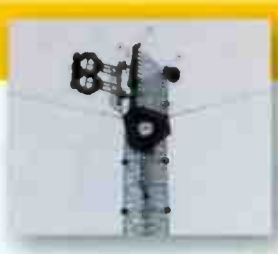

Radio

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Cris Alexander On Technology Disconnect

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For the entire story...

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Which one of these doesn't belong? Microphone. Console. Monitor. Or, that noisy, lump-of-a-box that is the PC workstation in your on-air studio?

The PC workstation obviously needs to go, and we don't mean to the equipment room where all the other noisy things end up. "KVMing" it from the TOC to the on-air studio just adds cabling and complexity that can mess up touchscreen controls.

The point is, you don't need it, as Greg Armstrong, the DOE for RadiOhio, will tell you. He recently installed thin client replacements no bigger than a laptop that snap onto the back of the studio monitor, doing away with all PCs for his group's six WheatNet-IP studios and four edit booths in Columbus, Ohio.

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Getting the Right HD Radio Blend

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As you've no doubt heard by now, Belar's ADC algorithm, a new feature of its FMHD-1 modulation monitor, makes live, off-air measurements of the timing differences between the HD Radio and analog signal. By combining Belar's ADC algorithm with the intelligence built into every Wheatstone on-air processor, the nagging problem of that not-so-graceful HD-blend-to-analog is finally solved.

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TABLE OF CONTENTS

"Director of First Impressions" Sheronda Blanton greets visitors at Radio One Dallas.

Photo by Steve Walker

COLUMNS

FEATURES

DEPARTMENTS

On the cover: A GatesAir RMX console in Radio One Dallas' studio. Photo by Steve Walker

FIND THE MIC AND WIN!

Tell us where you think the mic icon is placed on this issue's cover and you could win a Hosa USX-110 mic-to-USB interface. Send your entry to radio@RadioMagOnline.com by **June 12**. Be sure to include your guess, name, job title, company name, mailing address and phone number. No purchase necessary. For complete rules, go to RadioMagOnline.com

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Let's Share — and Learn From — Good Ideas

As I write this, I've been back from the NAB Show for about 10 days, and I'm still recovering.

My major take-away from the convention was that, though many consider radio broadcasting to be a "mature" industry (meaning low-to-no growth) there are many new applications of technology being applied to the field. Quite a few of those are being developed overseas, particularly in Europe, including some of the most innovative ones that I saw at the show.

I've moved around the country quite a bit during my career, and a positive aspect of that has been my exposure to different techniques used to solve similar problems. Yes — in San Francisco, and New York, and Los Angeles, everyone uses transmitters; but the finer details of how transmitter sites are built and maintained vary from area to area. For this reason, it's very interesting to see how our European colleagues address similar problems. Just as you get some insight into life, in general, by travelling overseas, you can get insight into problems that are common to all broadcasters as you study more and more techniques used in solving them.

No one has a monopoly on good ideas. My advice to you (even though you didn't ask for it) is to see how others approach the same problems you have; take your best solutions, take their best solutions, and apply all of them the next time you have an opportunity to do so.

Conversely, don't necessarily do things "the way it's always been done" just because it's the most obvious way forward. Technology and techniques evolve over time. We're no longer using wire with cloth insulation; we're no longer using Christmas trees for wiring; and we're no longer able to just shove a rack in the corner of the air studio with a modulation monitor and remote control and call it good.

One of the negative aspects of the mid-90s consolidation era was that we all had more stations heaped on us. But the flip side is that we're all forced to learn about new technology used to let one person (or a small staff) handle multiple stations. Many of the techniques used to "increase productivity" are derived from the cellular and IT industries; it's just the way of the world now.

In this issue of Radio, we've again presented articles that are meant for readers who are at different levels of experience. Lee Petro and Jeremy Ruck are discussing aspects of our business that will make the most sense to readers of longer experience; in my Tech Tips column, my aim is to help those who are beginners in the field; Trends in Technology, as well as the Field Report, should be of interest to all.

We're continually working on improvements for this magazine and appreciate your feedback. If you have comments or ideas on the content, please forward them to radio@radiomagonline.com. Thanks for reading Radio, and I hope you enjoy our work for this month.

Doug Irwin | Technical Editor

Radio
THE RADIO TECHNOLOGY LEADER

May 2015 | Vol. 21 No. 5

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Member: American Business Media

A NewBay Media Publication

NewBay Media, LLC
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SUBSCRIPTIONS: Free and controlled circulation to qualified subscribers. Customer Service can be reached at: newbay@computerfulfillment.com or by calling 888-266-5828 (USA only) or 978-667-0352 (Outside US) or write us at Radio Magazine, P.O. Box 1884, Lowell, MA 01853, USA. Back issues are available by calling Customer Service.

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REPRINTS: For custom reprints and eprints please contact our reprints coordinator at Wright's Media 877-652-5295 or NewBay@wrightsmedia.com.

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Radio, Volume 21, Number 5, (ISSN 1542-0620) is published monthly by NewBay Media LLC, 28 East 28th Street, 12th floor, New York, NY 10016. Periodical postage paid at New York, NY and additional mailing offices. Postmaster: Send address changes to Radio, PO Box 1884, Lowell, MA 01853.

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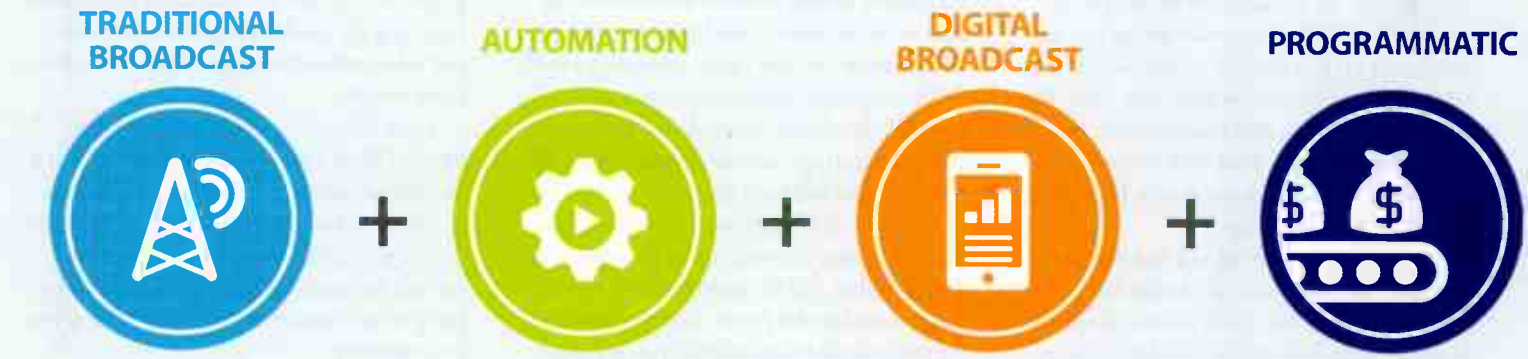

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Changes to Sponsorship Identification Proposed

by Lee Petro

In November 2014, a group of nine broadcasters filed a Petition for Class Waiver of Section 317 of the Communications Act, and Section 73.1212 of the FCC's rules, to alter the sponsorship identification disclosure rules. The broadcasters seek to shift their primary sponsorship identification disclosure requirements to their station websites and to only be required to run a notice once daily.

The Petition is classified as a waiver in order to fit it within a provision of Section 317 of the Communications Act, which permits the FCC to waive the sponsorship ID rule for a "case or class of cases," if the public interest would be served. According to the petitioners, the proposed modifications would apply to a "class" of stations that air sponsored music and/or sports programming. Previously, the FCC granted requests for the waiver of Section 317 for two other classes — feature motion picture film producers and individuals placing classified ads.

The proposed waiver would apply to radio stations that air music and/or sports programming. The petitioners argued that the proposed rules would be more flexible and would lead to fewer interruptions. Also, the proposed rules would provide more information than what is currently aired on stations, although listeners would need to access the station's website to obtain the information.

The proposal would permit a licensee to run a daily on-air announcement, which indicates that certain programs are being sponsored, the identity of the sponsors, and direct the listener to the station's website for more information. The daily on-air announcement would be required to air between 6 a.m. and 7 p.m., seven days a week.

The enhanced website disclosures would provide information regarding the person or entity sponsoring a particular program, list all programs that had been sponsored by that person or entity, list the artists and songs or sports teams that were featured during the sponsored programming, and the type of consideration that was paid by the person or entity sponsoring the programming, and the type of consideration that was paid by the radio station in return. The petitioners have specifically carved out of the amount of consideration that was involved in the sponsorship, noting that the disclosure of the amount of consideration has never been required.

In order to prepare the public for this proposed shift in sponsor ID disclosures, the petitioners proposed a three-week "public education" period. During this period, a station or group of stations seeking "class" status would be required to air four listener educational announcements each day.

Announcements during the week would be aired during morning and evening drive time, and one each between 10 a.m. and 3 p.m. On weekends, the announcements could be aired between 6 a.m. and midnight, but one would have to be aired between noon and 2 p.m. The announcements would contain information that the station in question airs sponsored programming, and that additional information regarding the specific program, its sponsors, and other information is available on the station's website.

Upon initial review, the petitioners may have a difficult time convincing the FCC that it should exercise its discretion to waive Section 317 of the Act and Section 73.1212 of its rules. The largest hurdle is that the petitioners have defined the exempted "class" as all broadcasters that provide music programming and/or sports programming.

While the talk radio format is popular, music and sports programming comprise a large majority of the available programming. Thus, the petitioners will likely need to convince the FCC that exception will not overwhelm the rule, and that the public interest would be served by shifting the disclosure requirements from on-air to the station's websites.

The FCC released a public notice seeking comment on the Petition. Comments were to be filed by April 13, 2015, and reply comments are due May 12. If the FCC receives sufficient comments to reach an initial decision to proceed, it will then release either a Notice of Inquiry or Notice of Proposed Rulemaking, seeking additional comment.

Petro is of counsel at Drinker Biddle & Reath, LLP. Email: lee.petro@dbr.com.

FCC DEADLINES

June 1, 2015 — Stations in Arizona, Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia West Virginia, Wyoming and the District of Columbia must place their Annual EEO Public File Reports in the station's public inspection file.

June 1, 2015 — Noncommercial stations in Arizona, Idaho, Maryland, Nevada, New Mexico, Utah, Virginia, West Virginia, Wyoming and the District of Columbia must file Biennial Ownership Reports with the FCC.

June 1, 2015 — Radio stations with 11 or more full-time employees in Maryland, Virginia, West Virginia and the District of Columbia must file a Broadcast Mid-Term Report (FCC Form 397) with the FCC.

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Radio One Dallas Builds for the Future

by Don Stevenson
Chief Engineer, Radio One Dallas

The Technical Operations Center is the heart of Radio One Dallas. The central UPS system, all servers, remote codecs and VistaMax systems can be controlled from here.

Photos by Steve Walker

The studio core sports an open cable tray, Industrial Acoustics doors and a straightforward layout, with control rooms and mixing studios on the left, production rooms on the right.

The slow death of the indoor shopping mall is an unfortunate reality, with properties nationwide losing tenants or going fully dark as American shopping habits change. Sadly, our longtime home at the Valley View Mall in North Dallas is among those on the decline. As our lease advanced toward expiration, we faced the difficult question that many broadcasters eventually address: Do we stay put or transition to a new space where we can build for the future?

The dilemma was quick to resolve in the case of Radio One Dallas. Reach Media, our syndication partner, populated the first and seventh floors of a spacious, modern office building two blocks away. The property owner was keen on increasing Reach Media's footprint, and within weeks, the signatures were dry. Radio One Dallas had a new 13,000-square-foot home on one half of the 11th floor, and began the process of building out studios and a technical operations center for KBFB(FM) and KSOC(FM).

Naturally, the space was not move-in ready. With architectural guidance from Merriman & Associates and a set of CAD drawings from GatesAir, the process of raising walls and running wires began.

TAKING SHAPE

The biggest challenge was the unusual shape of the building, which significantly narrows near the center. After rifling through several floor plan variations, Merriman & Associates handed the project off to the general contractor to build out the separate studio and office spaces. Initial electrical work ensured a robust connection to an existing Reach Media-owned Onan 150 KVA generator. With plenty of headroom to support two stations, we eliminated the costs of installing a new ground-level generator with 11 floors of conduit and wiring.

Radio One has traditionally avoided "turnkey" systems as a matter of preference. However, the quick turnaround requirement and unusual space

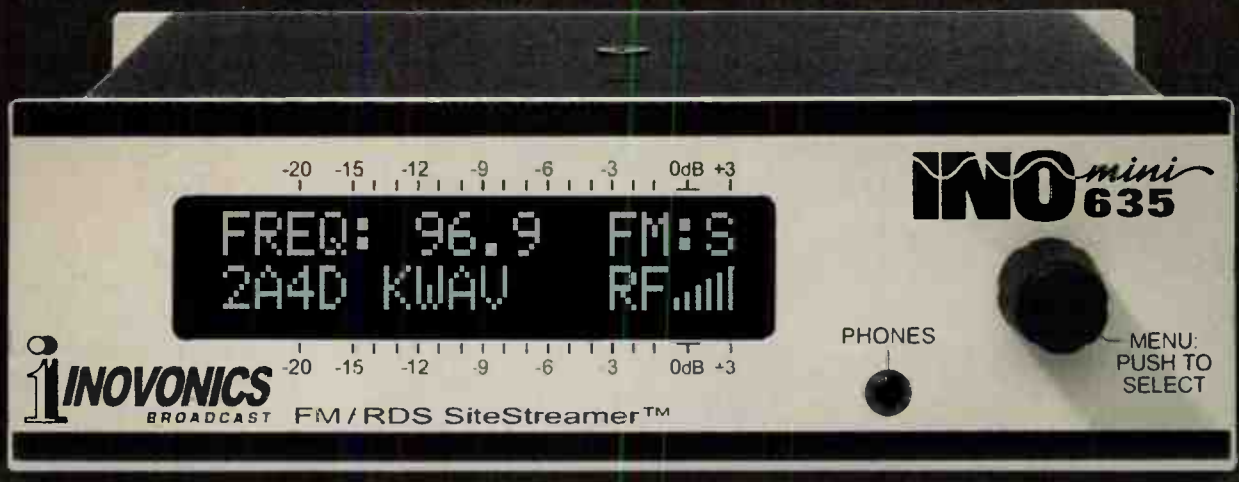

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Photo by Steve Walker

Melvin Keller of "The Big Baby Show" uses a GatesAir RMX console and the Yellowtec Mika series mounting arm system.

presented an opportunity to explore that route. Upon choosing GatesAir, the team fired up the AutoCAD program for studio design, and began measuring cable runs lengths for the various studios. Soon, their integration team was onsite running 25-pair CAT5-rated cable with appropriate connectors between the various studio spaces.

The initial wiring job was completed within a few hours. The transition to networking cable accelerated the process compared to the tedious, labor-intensive integration of shielded audio pairs, where we'd spend days working with heat shrink tubing and terminating hundreds-to-thousands of cables across multiple spaces. With connectivity to Krone punchblocks, the overall result is no exposed wiring as with older 66 blocks — and no risk of shorting out. The CAT5 infrastructure additionally has been kind to audio quality, with no evidence of crosstalk or dropouts that are often a concern for broadcasters.

IN THE TOC

The technical operations center is the heart of our operation, as with most radio networks. However, the TOC design continues to evolve due to improved networking platforms. While the option remains, there is increasingly less of a need for that enormous "traffic cop" router, with huge cable bundles coming out of the back panel for termination. Our design favors a more modern distributed architecture, which reduces both the footprint and complexity of the overall system design.

The TOC features eight equipment racks, with the majority built by GatesAir; and two specialized Middle Atlantic racks with greater depth (42 inches). These racks allowed us to cleanly integrate deeper units related to network interconnections, network switching and cable management, while comfortably leaving the rear doors intact. Overall, this made for a much cleaner installation. Additionally, we installed three redundant 12KVA Eaton Blade UPS systems in these racks, all wired to a bypass panel and operating in parallel to ensure we're always on the air.

Moving away from the traditional core router, we opted for the GatesAir VMConnect audio management frame as our hub. With a base management of 192 bidirectional stereo

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audio and associated logic channels that can be scaled for higher capacity, the VM-Connect offered the ideal solution as a compact hub for networking across two on-air studios, four production studios and two mixing studios.

The VMConnect is configured for a distributed architecture as referenced above, feeding six VMXpress audio and logic interface devices for edge routing. All studio consoles connect to VMConnect and the VMXpress units via CAT5. Separately, program audio from each console connects to a Broadcast Tools switcher, providing an additional redundancy layer as we are installing firmware upgrades or switching cables on the VM systems. These switchers feed directly to GatesAir Intraplex IP Link codecs for transport to the main transmitter site.

The remaining GatesAir racks are chiefly populated with WideOrbit automation PCs and an array of IT servers and common computers. All racks are well ventilated, with two 7.5-ton Liebert air conditioning systems consistently cooling the equipment in a main/alternate configuration.

The in-studio racks have studio and Audion Labs VoxPro PCs, Wheatstone M2 mic processors, Denon DN-700C networkable CD/Media players, a GatesAir World Feed Panel and dual redundant power supplies, as well as some additional needed gear.

Photos by Steve Walker

Control rooms have Mackie HR824 studio monitors, clocks and timers from ESE, Telos VX phones, 360 Systems Instant Replays and a WideOrbit digital media playback system.

In a more unusual twist, we installed the IP Link codecs not only for STL transport but also to backhaul audio from our Pico Digital XDS and Wegener satellite receivers which are located at our main transmitter site. Upon moving into the facility, we were informed of the property owner's preference for no rooftop satellite dishes. With no available ground space to install a satellite dish, our best option was to move the dish and receivers to the main transmitter site.

In conjunction with IP microwave systems, the satellite receivers deliver program audio for FM, HD1 and HD2 channels to GatesAir Intraplex IP Link 200 codecs for backhaul to the TOC, with streams triggered via built-in contact closures. The IP Link 200s were selected for the main transmitter site to accommodate dual FM and HD streams coming from the satellite receivers, and deliver that audio to the TOC. IP Link 100s — the single-channel version — provide an STL connection for the single FM feed to the backup transmitter site.

CONNECTED STUDIOS

Radio One opted for GatesAir NetWave digital consoles for the four production studios. However, we decided to go bigger for the on-air studios, selecting GatesAir's RMXdigital 20 consoles. They add a bit of horsepower to the

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broadcast operation.

The two on-air rooms are approximately 15x15, a bit smaller than our old ones and driven purely by the space we had at our disposal. Using custom GatesAir furniture, the overall atmosphere is upscale, with unusual shapes from the countertop to the equipment turret outfitted with Wheatstone M2 microphone processors, Sage EnDec EAS units and a GatesAir World Feed Panel for universal I/O connections. Each on-air desk has one host and three guest positions, with 3x6 headphone controls and jacks built into the surface. Yellowtec mic arms support Heil PR40 microphones at each position, and the main guest position has a Telos VX phone system for request lines.

The host position features WideOrbit automation for media playout (music, spots, promos), a VoxPro editing system and the console. The WideOrbit system is extremely solid and reliable, and does an excellent job feeding song title and artist information to our transmitters. One of the cooler features of the RMXdigital is a built-in delay dump button, one of several programmable buttons on the console. This button lights up green if in the "safe zone" of the delay, turns yellow if time is dwindling, and red if there is not enough capacity to dump audio.

The RMXdigital is a programmable console and is routable to any networked location. While we are still learning some of the programming options, like saving and recalling sessions, we have put the mix-minus capabilities to good use. The jocks were able to grasp how to feed audio down to the phone, record and mix it into the live broadcast. It's intuitive and has helped to enliven the broadcast with guest callers.

The production rooms are similar, with GatesAir Quickline furniture and NetWave consoles anchoring the room. Like the RMXdigital consoles, the NetWaves feed into the networked architecture for source sharing and audio/logic routing to any connected studio. Three of the production rooms have one host and one guest position, while the fourth includes three guest positions to accommodate traveling shows and guest broadcasters. For example, the "Ricky Smiley Morning Show" often broadcasts from this studio.

The final two studios are outfitted with nightclub-style DJ mixing equipment, which are used often, given the hip-hop format of both stations. Each room has a Rane Sixty-Two DJ mixer and Pioneer CDJ-1000 turntables. These rooms can function as satellite studios for the on-air and production rooms, each of which can take a live feed via VMXpress.

With the move complete and both stations live from the new studios, the overall system can simply be described as clean, manageable and smartly integrated. The amount of preplanning that went into the project, along with the skilled on-site engineering, accelerated the entire process to get us on the air quickly. With a distributed architecture that offers plenty of capacity for future changes and additions, Radio One Dallas is well positioned for a long and bright future.

RTL Nederland Tests Out Z/IPStream

by Fardau van Neerden

Online consumption of content, both audio and video, grows significantly each year. Online offerings for movies, TV and music are becoming more and more common. The industry is moving at a fast pace, challenging for engineers who come mainly from traditional radio and have little time to keep up.

Although online streaming of radio is something radio has offered for a long time, I've noticed that we haven't kept up with the latest technology and functionality often offered by online-based video/music platforms. Yet, people demand that we offer any content on any platform or device, without losing any of the functionality of traditional FM/HD Radio — and, of course, for free.

ADAPTIVE STREAMING: WHAT WE CAN LEARN FROM VIDEO

Looking at technical solutions already available for transporting audio and video content (driven by such video on demand platforms as Netflix, Hulu, YouTube and others), we found that they all rely on "adaptive bit rate" technology, a technique that creates streams of multiple bitrates, segments them in a specified length at the encoder side, and offers all bitrates to the client, which decides which bit rate to play.

Adaptive streaming also offers the possibility of a seamless switch between bitrates at the user's device, depending on factors such as available bandwidth, local CPU/memory resources, and player capabilities. Although there are a few different implementations like Microsoft Smooth Streaming, Apple HTTP Live Streaming and Adobe HTTP Dynamic Streaming, they all work using the same adaptive principles. Yet, we found that none of these offered an audio-only solution suitable for online radio streaming. After closely examining the specifications of these adaptive streaming techniques, we settled on Apple HLS as the best candidate for audio-only adaptive streaming. The reason for this is that HLS has a broad adoption on the market by mobile and tablet devices. For desktop playback, we teamed with JW Player for a Flash player capable of HLS audio only playback. One problem: there were no encoders out there to make it work!

So, together with the BBC, RTL reached out to Telos and began testing its new Z/IPStream X/2 software encoder then in development. This software would generate a multi-bit rate smooth stream, to be ingested by a so-called "origin server." This origin server would then repackage the smooth stream on-the-fly to Apple's HLS for client playback. Although it was at the time a beta product, it proved to be production-ready and ran extremely stable; after several months of testing we started using this in a production environment.

LEVERAGE CONTENT DELIVERY NETWORKS

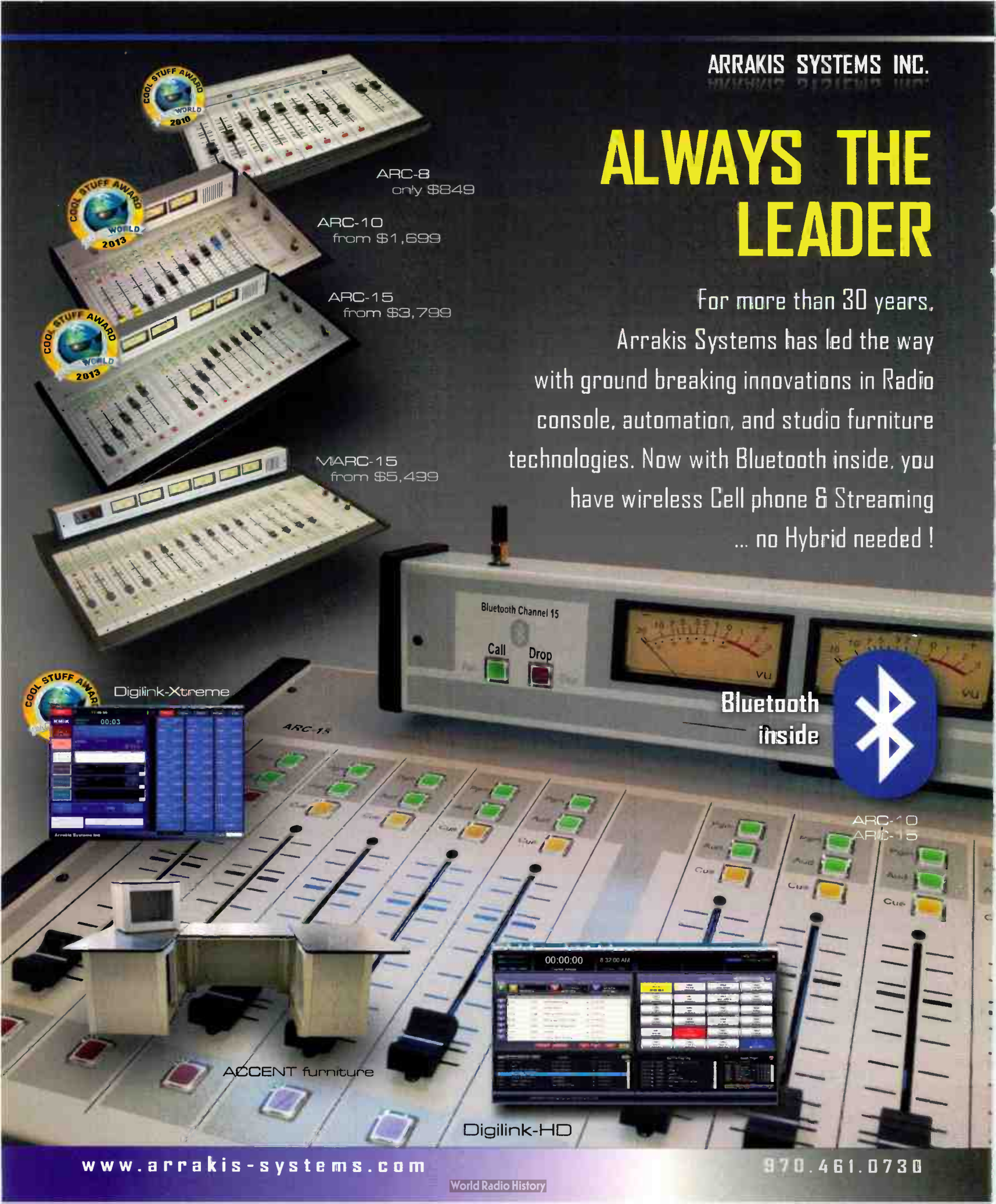
Because the Z/IPStream software uses the same adaptive streaming over HTTP as has already been widely adopted by video, it benefits from the use of existing content delivery networks. These networks can handle huge amounts of traffic, so reaching huge amounts of listeners is not a problem. And individual audio-only streams are relatively small, so bandwidth consumption is reduced even further, making an adaptive streaming implementation very cost effective.

A great benefit of the adaptive technique is that, should the CDN platform or network become congested, playback clients sense the congestion and automatically switch to lower bitrates, thus lowering the incidences of buffering. This happens without any end-user intervention. Furthermore, since some firewalls and network proxys filter RTMP/RTSP/RPT traffic, HLS streaming (which is based on HTTP instead) is more likely get through to end-users.

Z/IPSTREAM SETUP

We configured our software so that one of our radio channels is encoded by the Z/IPStream encoder and pushed, via the open Internet, to two origin servers. These servers then dynamically produce either HLS, Smooth or HDS streams (in our case, HLS). The origin servers could even add dgital rights management protection at your request if necessary. The output is easily cached by CDN servers for huge amount of listeners. We've been running this setup ever since without any problems.

RTL is using the upgraded Z/IPStream 9X/2 software variant; while the base Z/IPStream X/2 is a very capable software, the addition of the software-based Omnia.9 encoder and audio processing tools to the Z/IPStream 9X/2 provides an even richer tool kit with which to shape sound.



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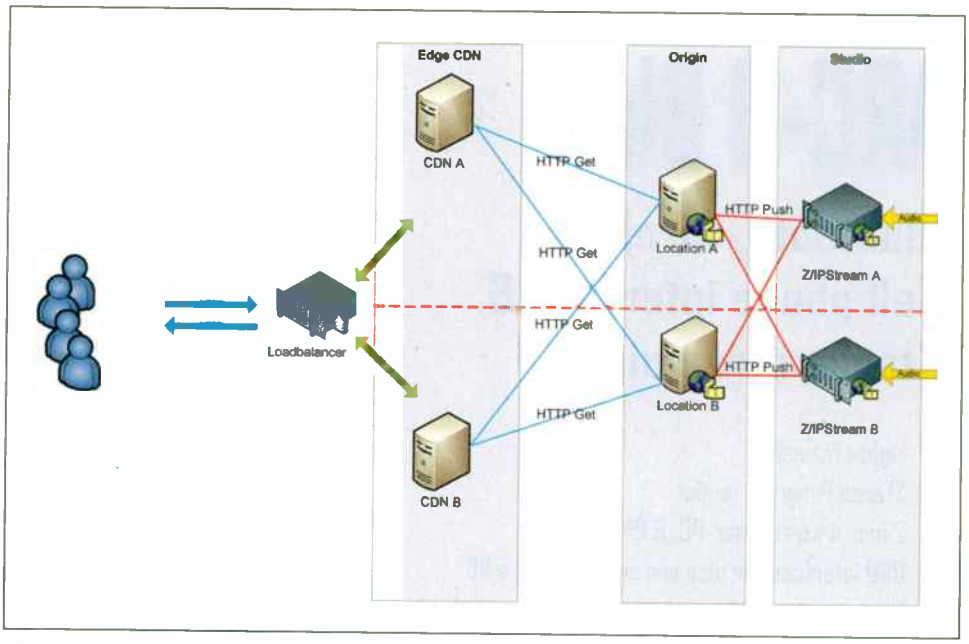


Fig. 1: Network configuration for RTL's streaming service (flows right to left)

Setup and configuration is easy. The Z/IPStream Web interface, based on HTML5, works in modern browsers with no plug-ins to install. (By comparison, Telos' older AX/E software relied on the Silverlight plug-in.) Depending on the type of audio processing and number of bitrates you wish to generate, you can run multiple instances on a single system.

FAILOVER/REDUNDANCY AND OVERALL STABILITY

Z/IPStream software is designed with redundancy and stability in mind. It is possible, in fact, to have separate encoder instances on totally independent servers take the same audio source, and produce exactly the same output! To achieve this, a timecode needs to be present in the source; both encoders will sync to this timecode and independently produce the same output. Both encoders can then send the output to multiple origin servers which will, in turn, repackage the stream in any adaptive streaming format. With this setup you can suffer from an encoder outage, an origin outage and (multiple) CDN servers may be unresponsive. Even with all these outages your stream will still be online. With the use of cloud-based solutions it's a matter of spinning up new or more instances if needed to meet your redundancy and scaling needs. (See Fig. 1.)

During our testing period, upgrades to newer versions proved to be as easy as running a setup wizard. All settings are automatically migrated to the new version, making downtime minimal. If you have the multi-encoder setup described above, there could even be zero downtime during upgrades. Adding more instances is as easy as a few clicks. Z/IPStream X/2 can also take advantage of multiple, redundant inputs like AoIP or any local soundcard.

CONCLUSION

We are happy with the new Z/IPStream product. It has proved to be stable and offers a great set of features. It uses the latest techniques, and gives us the ability to move into the future with online streaming of radio. And we can benefit from future improvements, as VoD services pave the way for us — giving us the time to focus on radio itself.

van Neerden is Senior System Engineer with RTL Nederland.

AoIP Technology Review

by Doug Irwin, CPBE AMD DRB

I know there are many legacy analog audio plants still running in radio stations in the U.S. (and the rest of the world). Undoubtedly some of them are a little "dog-eared" and frayed around the edges. If you are in charge of a plant like this, it's time to consider your options, so that you'll be ready for the planning of upgrades, or to build an entirely new plant. In this article, we'll look at many of the options available to you: Not only the newer audio over Internet protocol systems, but time domain multiplex systems that support AoIP interfaces, as well.

Before we look at the various vendors for AoIP systems, let's review, very briefly, the basic premise of an AoIP network.

In a TDM system, a large "core" audio router ingests all the audio sources, and in turn has connections to all the destinations on the network. Inside the router is a cross-point (electronic) switch; this is where a source is connected to an amplifier that drives the signal to the far-end destination. More than one destination can be connected to the same source; and often multiple sources are added to make a bus. The core is at the center of a spoke-and-hub system; spoke connections are made via TDM, which is a synchronous serial data stream. Each "time-slot" is associated with a digital audio path. The major components of the system are always proprietary to the particular manufacturer.

The first two AoIP systems we'll talk about use a distributed system of audio inputs and outputs and logic control; this is a fundamental difference with respect to the TDM (core) systems. Whereas TDM systems generally make use of proprietary hardware for the interconnection of studios to the hub, the first two AoIP systems provide the routing and interconnection via what really boils down to a local area network, built using CAT5e, CAT6 or fiber connections, and commonplace, high-quality layer-2 (Ethernet) switches.

Wheatstone is a very well known AoIP system manufacturer, with multiple consoles choices. The LX-24 is a low-profile, tablet-top console, with 24 input modules, four stereo busses, four pre-fader Aux sends, four mix-minus busses, a stereo cue buss and a bus-minus output for each fader. An LED source name display, an A/B source selector and two programmable soft buttons are also available, and a Set button provides access to assignable controls in the master section. The modules are hot-swappable down to the individual fader.

The LX-24 works in conjunction with an IP88E Blade 3, which contains all of the DSP processing to support the control surface.

Wheatstone LX-24

(Each Blade in the Wheatstone system is a single-RU form factor.) The IP88E doesn't house audio I/O, but it does include 12 universal logic (GPIO) ports for interfacing various external switches, indicators and devices for control purposes. All the audio inputs and outputs of the system are done by way of additional Blades, each of which has a specific purpose: microphone level inputs; analog

Axia Element

inputs/outputs; AES inputs/outputs; mixed analog/AES; digital logic blades. The audio blades are AES67 compatible.

The E-6 is another console option from Wheatstone. Like the LX-24, it's meant to work inside the Wheatnet AoIP system, connecting via a single CAT6 cable. It has a low profile but can drop in to a counter-top cutout, with frame size up to 24 channels. E-6 has four stereo output busses; four mix minus busses; individual fader mix-minus outputs with talkback; and, four aux output busses. Line inputs have eight-character source displays. A meter bridge is optional; alternatively, you can use a VGA monitor to display console metering, with clock and timer as well. The same monitor is use in conjunction with a touchpad and left/right click buttons, built in to the console surface, to access infrequently used controls, and for console programming.

As with the LX-24, you can save a copy of the console configuration, recalling it for later use: all sources, bus assignments, and other settings. Different levels of user access are available, so that more experienced users can complete more complex tasks.

Axia is another very well-known manufacturer of AoIP networked systems. One of their consoles choices is known as Element; it's a modular console, with frames available in sizes from four to 28 positions, with support for up to 40 faders in multiple, linked frames. The Element control surface works with the Axia PowerStation and StudioEngine DSP mixing engines and connects to the Axia network with a single CAT6 Ethernet cable. Element features four stereo program buses, four send buses, two return buses and a number of VMix (Virtual Mixer) channels, which allow combining up to five audio sources for presentation on a single console fader. A variety of module types provide control of mic/line inputs, telephones and other devices.

Another console choice is the Axia iQ — which can operate as a standalone console, or be connected to Axia network. iQ is a console system that can be used to build custom consoles of sizes from eight to 24 faders. The basic system consists of one iQ 9-Fader Main Frame and one QOR.32 integrated console engine, which incorporates analog and digital audio I/O, GPIO and a custom Ethernet switch. iQ features three dedicated stereo Program buses, plus a stereo Utility bus that can be used for phone calls, off-air recording, or as a fourth program bus. Automatic mix-minus is provided on each fader, plus talkback functions, one-button off-air record mode, show profile functions for instant recall of up to four predefined console "snapshots," high-resolution OLED program meters switchable between VU and PPM metering styles, OLED option and source name displays on each fader strip, studio and control room monitor.

Audio ingress and egress can be done on an Axia network by way of xNodes, which are 1 RU in height, half-rack in width, and available in analog, AES, microphone-level, mixed-signal and GPIO versions. They can be powered by way of AC or Power-over-Ethernet. xNodes are AES67-compatible.

It's also important to consider that any device that is Livewire compatible will "talk" directly via Ethernet with the Axia network.

Logitek is another manufacturer of console and router systems, including both AoIP and TDM types. The ROC will serve in on-air or production rooms as an integral part of the Jetstream AoIP platform. It's available in sizes up to 24 slots (with 18 channels) though it can be expanded with additional banks of six channels. Four assignable output busses; Penny & Giles 100 mm long throw faders; an optional meter bridge that displays program and switched source levels with dual OLED screens for timers, clock, profanity delay indication or user-defined text.

Another option from Logitek is the Mosaic, also an integral part of the JetStream AoIP Audio Networking platform. The Mosaic is presented in a counter-top design that allows one to move the board out of the way when not needed. It's available in sizes ranging from four to 24 faders, with two options for meter bridges. OLED screens are used throughout for source identification and confidence metering; illuminated rotary controls and programmable backlighting for on/off and

selector buttons allow custom color-coding for operators. As with all Logitek consoles, any source can be assigned to any fader, and each fader provides easy access to control functions as well as indication of bus assignments and level metering.

The JetStream Mini is an integrated console engine and AoIP routing platform, handling console functions as well as audio routing duties. One JetStream Mini can support up to 128 digital or analog inputs/outputs; 24 mix-minus busses (assignable to any fader of any Logitek console connected to the router); nine program busses; 32 channels of stereo audio shared between one to four Logitek consoles; EQ and dynamics processing assignable to any fader; and fader input metering with audio level alarms. StudioHub+ inputs may be directly connected; breakouts are also available for DB25, XLR, BNC (digital I/O) and punch blocks.

Another important aspect of the JetStream AoIP system is that it now incorporates Livewire connectivity protocols and provides direct network connectivity to all Livewire partners. According to Logitek's Web page, JetStream is compatible with Ravenna and AES67.

The manufacturers of more traditional TDM console/router systems are providing AoIP options for their new and continuing customers as well. As an example, SAS is now offering the KEL-16 and KDL-16 plug-in modules for their well-known 32KD routing system. The KDL-16 module provides 32 channels of 24-bit linear audio, and utilizes the Dante AoIP protocol from Audinate; it also supports AES67 and Audio-Video Bridging (AVB). The KDL-16 is suitable for direct ingest of audio from digital audio workstations over an IP LAN or WAN and comes with audio sound card drivers (or Virtual Sound Device Software) that supports both WDM for PC Windows and ASIO for Mac OS systems.

Logitek ROC

The KEL-16 provides 32 channels of selectable Bit Rate Reduced algorithms (such as AAC-LC) for use over standard IP LANs and WANs, making it suitable for the transport of multiple channels of encoded audio to and from any location that has IP connectivity. It can also be used to connect

GatesAir VMXpress IP

multiple 32KD routers together via IP, with all 32 channels of bidirectional audio using about 2 Mbps of bandwidth.

GatesAir is adding a new element to their VistaMax (TDM-based) console/router systems — the VMXpress IP. This device is an AoIP gateway for the VistaMax system, using RAVENNA; as such, VMXpress-IP is AES67-compliant. The benefit of the AES67 standard is that the AoIP streams going out of VMXpress-IP will talk directly with other manufacturers products that are also AES67-compliant; that could include studio gear, audio processors, STL systems, and the like. Conversely, VMXpress-IP will provide a means by which other AES67-compliant devices can communicate directly with the VistaMax routing system.

There are many console and routing system manufacturers from outside of North America that are worth considering when you upgrade your plant. I realize that there is a certain reticence in looking to overseas manufacturers when it comes to systems such as this. A primary concern is potential difficulties related to customer support with respect to language and time zone differences; however, I would look at the functionality, features and quality of construction first, as they really are more important than whether or not you can get customer support over the telephone. Much of that will be done via email, regardless.

Lawo is a well-established German manufacturer of consoles and routing systems. Their radio consoles include the crystal series (up to 16 faders) and sapphire series (up to 60 faders); their routing systems


Lawo Crystal

are based on TDM connectivity.

In a typically sized radio station facility, one would likely consider the Nova17 router, which supports up to 128 inputs and outputs with its standard analog and AES plug-in cards. An optional type of plug-in module for the Nova17 is the multichannel audio digital interface (MADI — also known as AES10) that supports up to 64 channels of audio; six of those can go in the Nova17 frame, thus ultimately allowing for up to 512 audio inputs and outputs in a 3RU frame.

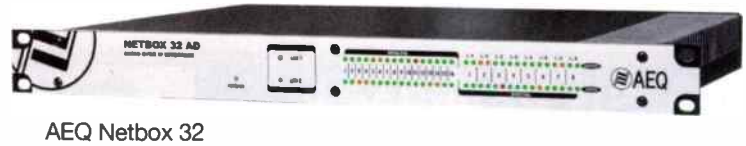
Lawo is taking the "hybrid" approach to AoIP inside of its console and router systems. They're about to introduce another plug-in module, which is a 64-channel hybrid MADI/IP extension card for the sapphire and crystal radio consoles as well as the Nova17.

Introduction of these cards in to existing systems allows for migration to AoIP audio sources (specifically, Ravenna/AES67).

AEQ is another manufacturer of consoles and TDM-based routing systems. The BC2214 AoIP plug-in card is designed to be installed in either AEQ's BC2000D frame (part of the Arena digital console systems) or in the Titan routing system. The inclusion of multiple copies of this card in the BC2000D frame would provide an ARENA console with access to as many as 512 audio inputs and outputs. AEQ's Netbox audio interfaces are used to get audio in and out of the routing system. The Netbox 32 AD has 32 inputs and outputs organized in to groups of 16 mono analog and 8 stereo digital channels. In addition, it accommodates 16 GPI/O, in a 1-RU form factor. The Netbox 8 AD is a similar device, with half-rack width, and supports eight inputs and eight outputs and four GPI/O. Both Netboxes communicate to the routing system by way of Ethernet, with two RJ45-style ports available. Audio and controls interfaces are done by way of db15 connectors.

AEQ has a Florida-based U.S. office, by the way, so service-after-sale questions can be forwarded to them.

Having spent many years maintaining analog radio studios, and after quite a few analog console installations, I'm not ready to simply write them all of as ancient history. However, the reality is that all consoles and systems eventually wear out (even if it does take 25 years); inevitably, as an engineer in charge of a studio plant, you will one day face that fact. It's always a good idea to keep abreast of the latest technology, even if you are not planning a build in the immediate future. That way, when the day comes that you learn a new plant is needed, you'll likely have a system in mind, and you'll be able to formulate your plan quickly and painlessly.



AEQ Netbox 32

Irwin is RF engineer/project manager for Clear Channel Los Angeles. Contact him at doug@dougirwin.net.

Set Up Your Shop

by Doug Irwin
CPBE AMD DRB

There seems to be a common notion among broadcasters that there are no new people getting in to the business. I dispute that — and I'll make my case at another place and time.

If you are new to the business, though, read on. We're going to talk about what you need to set-up shop, so that you can be effective as soon as possible while taking on this new role.

WE WANT YOUR TIPS

Tech tips may be suitable to earn SBE recertification credits. Send your tips to radio@RadioMagOnline.com.

Hand tools. If your background is in IT, then likely you're going to have hand tools that will work in the radio engineering shop, since at least half of it consists of computers.

I have found, though, that many younger people with technical backgrounds still don't know how to solder. This is a skill you'll need to acquire as soon as you can — because unlike the IT world, many cables used in the day-to-day world of radio require self-assembly.

Get a soldering iron, find a place to use it that has the necessary ventilation, and start practicing. There are tutorials on YouTube that can get you started.

These are the basic soldering tools needed in every engineering shop.

Cable testers. The assembly of cables should always be followed by a quick test, whether they are RJ45 type Ethernet cables or microphone cables to be used at a remote. The Rolls CS1000 is definitely worth considering because it tests many different types of cables, including XLRs, TRS connectors, 1/8-inch connectors and the all-important RJ45 style Ethernet connector. There are many other cable testers out there, of course.

TECHTIPS

Custom cables. Every facility will have its own particular needs for custom cables. In practice, the driver of the custom cable need is whatever console is in use. Determine the type of connectors used for console's signal inputs, and its signal outputs; then, make up the following set:

- XLR female to console input type
- Console output type to XLR male
- Console output type to 1/4-inch TRS female (for use with headphones)

Note that on the headphone cable, you'll use one side only of an analog output. Wire up the "+" output and ground (or common) to one headphone input side, and the other channel's "+" output, and ground, to the other headphone input. Having a good pair of headphones is very important; it allows you to use the most important piece of test gear at the radio station — your ears and brain.

Signal generators/receivers. When you connect piece of gear A to piece of gear B, one of two things can happen: Either it will work, or it won't.

When it doesn't work, you have two things to look at. Is the cable good? (See above.) If the answer to that question is yes, then you move on to the signal generator/receiver step, because either A isn't sending, or B isn't receiving. You will substitute a known-good signal source for A, and if necessary, a known-good signal receiver for B.

One choice among many for a signal generator is the Ward-Beck ABS-1, which generates an AES3 digital audio signal, of 1kHz or 400Hz, at the three most commonly used sampling rates of 48 kHz, 44.1 kHz or 32 kHz. Digital signal levels of –20, –12 and 0 dBFS are front panel selectable. Stereo analog tones of 1 kHz or 400 Hz may also be selected at levels of –16, –8 and +4 dBu; outputs are 1/4-inch TRS. To distinguish between the CH A and CH B (left and right) signals, the unit provides the option to cycle and/or invert the CH B (right) signal or to turn it off completely.


A cable tester and DMM are must-haves for every engineering shop.


A signal generator as well as a signal receiver are important tools that facilitate analysis of problems at a radio station.

The complement to the ABS-1 is the ABB-1, which provides the convenient way to monitor both digital (AES/EBU, S/PDIF) and analog audio signals. Digital and analog program audio can be monitored by the headphone output while the L/R levels are displayed on LED bar graph meters. AES3 signal parameters such as sampling frequency, emphasis, professional or consumer format, and data errors are displayed when monitoring AES/EBU or S/PDIF signals. Digital input monitors sampling frequencies from 30 kHz to 50 kHz automatically. Analog inputs are done via 1/4-inch TRS connectors. Both the ABB-1 and the ABS-1 can be powered by batteries, meaning they're easy to carry around.

Handheld DMM. The most important features of any handheld digital multimeter are its ability to measure AC and DC voltage; resistance; and AC or DC current. 95 percent of the time, you'll be using the first two features. Obtain a DMM immediately.

We'll continue this topic in next month's Tech Tips column. In the meantime, if you have any of your own tips to share, by all means send them in to *radio@radiomagonline.com*. We're always interested.

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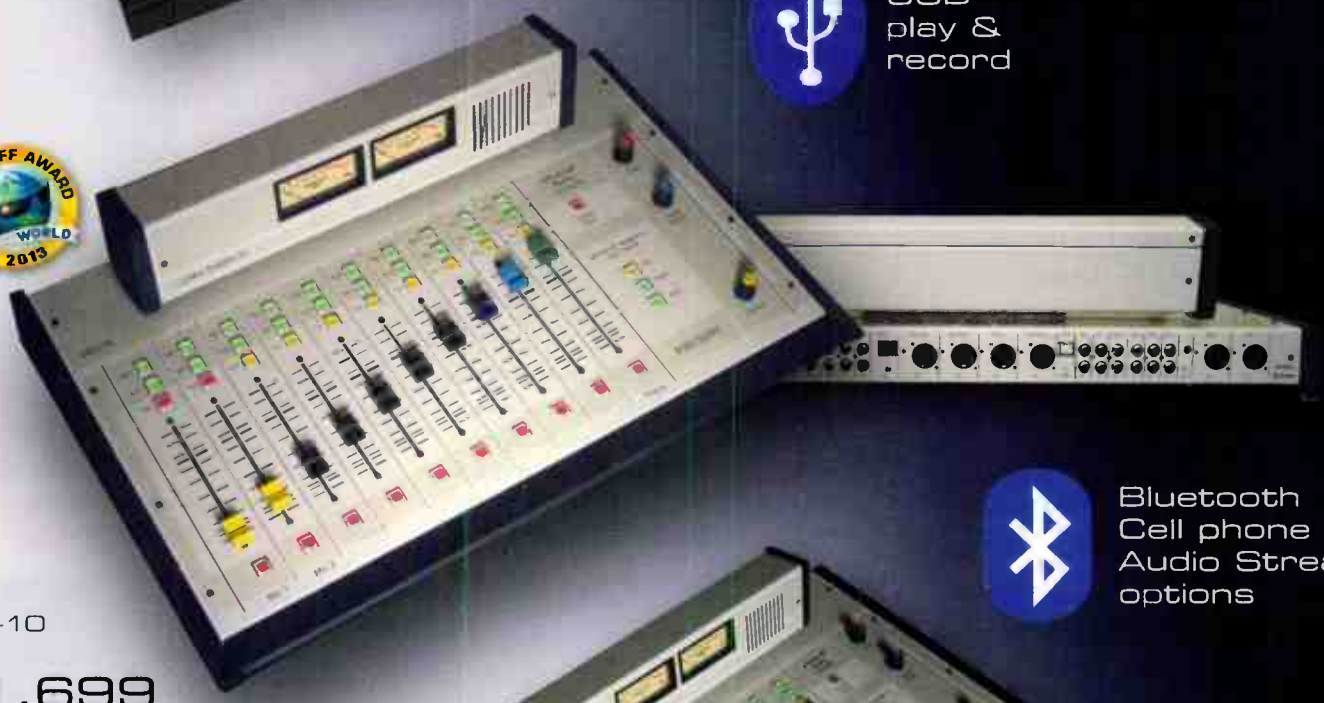

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Non-Directional Antennas Are Like Unicorns

by Jeremy Ruck

In the precious little spare time available to me, I sometimes find myself being drawn to science fiction and fantasy literature. I know I know it offends the sensibilities that a geeky engineer would, on occasion, delve into such recreation, but tales of valiant heroes, fair maidens and magic provide an escape from the sometimes harsh reality that is broadcast engineering.

One of the most enduring legends is that of the mythical unicorn drinking at the waterfall surrounded by rainbows. The modern-day broadcasting analog to the unicorn is the non-directional antenna, and like that noble creature of lore, it does not exist.

To be sure, we all give Non-D radiators lip service, but none of us can actually construct one in reality. This is true whether we are talking about AM or FM antennas. Indeed, should any of us be able to actually fabricate such a construct, I submit that the concerns of the day would become sand and sun on some tropical island rather than the practice of our current art.

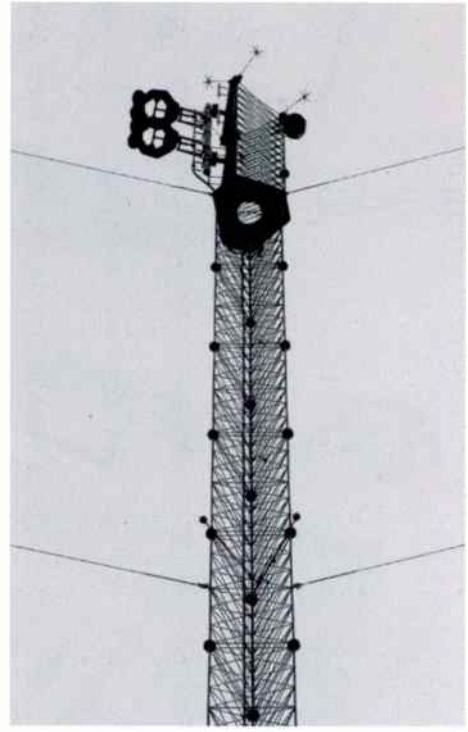
Recently the question of directional versus non-directional has reared its ugly head once more.

The issue at hand is a station in Texas where techniques and apparatus were utilized to ostensibly create a pattern that is more omni-directional than would typically result due to tower interaction. The perceived result is that one station wound up with better rim-shot coverage into a heavily populated region, while a co-channel facility on the opposite site of the metro is being pounded by interference. The complaint, of course, is that the non-directional antenna utilized is not *really* non-directional and was heavily engineered to distort the pattern.

It should be axiomatic that mounting an antenna to a large metallic mass, i.e. a tower, is going to cause distortion in the radiated pattern. You know this, I know this, the antenna manufacturers certainly know this, and whether they want to admit it or not, the commission knows this. The reality is even the naked antenna in free space is going to have some directional characteristics to it. The tower exacerbates this situation.

BACKSTORY

In 1984, the Federal Communications Commission issued a Public Notice discussing the criteria for licensing of FM Broadcast Antenna Systems. In that notice, the commission stated it "...assumes that FM non-directional broadcast antennas have perfectly circular horizontal



An example of a two-bay nominally non-directional antenna in radomes.

A four-bay directional antenna with parasitic elements in Bloomington, Ill.

radiation patterns." The knee jerk response to this statement would be to ask the commission what color the sky is in their world. However, if we take a more circumspective approach, we can actually see the wisdom behind that statement.

How much computing power did you have in 1984? If you were like me, you may have had an Apple II+ with 48K of RAM, or maybe a PC. The point being, computing resources were not as pervasive then as they are now, and having to consider each and every pattern as it truly is would have taxed stations and the commission unduly. Furthermore, there would have been significant amounts of squabbles over the veracity of submitted data. By making the pure non-directional assumption, the commission quelled those arguments, and more or less leveled the playing field.

Of course, in the end, the commission did leave itself an out, even from the occasional malcontent. Section 73.209 specifically points out that permittees and licensees are *not* protected from interference, except from Class D stations, that may result from the grant of new stations or modifications made in accordance with Section 73. This section is a recognition that station coverage does not end at the protected contour, that terrain is irregular, the geographic spacings method is imperfect, and implicitly, that there ain't no such thing as a truly omni-directional antenna.

So the question of the day is when does a "non-directional" antenna become directional?

The 1984 Public Notice states "...any technique or means (including side mounting) which intentionally distorts the radiation pattern of what is nominally a non-directional antenna makes that antenna directional and it must be licensed as such."

Adding parasitic elements and utilizing non-standard mounting brackets would seem to definitely fall under attempts to distort the pattern. But what about side mounting? Ideally, every FM antenna would be mounted to a pole on the top of a tower. Such a scheme would ensure the greatest circularity of a given pattern. That is, of course, unrealistic. Not only would this pose certain structural concerns, but it could easily substantially increase the required number of sticks to accommodate all stations. This would most certainly give heartburn to the trifecta of local zoning officials, concerned residents and environmentalists, not to mention the concerns of the FAA.

The reality is that there are necessarily going to be antennas mounted to the side of a tower. This includes leg and face mount configurations. Each will affect the pattern to a different degree, and tower face size plays a large role in that.

A number of years ago one of the major antenna manufacturers released a software package that allowed you to estimate the impact of the structure on an FM antenna. Their package allowed for consideration of pole-, leg- and

face-mount configurations. The program also considered frequency of operation and face size, if applicable. In perusing their pattern library, I noted that the maximum estimated relative field values tended to be at 1.6 or less. This means that they are estimating the pattern maxima to be within approximately 4 dB of circular. That is a pretty huge difference, but honestly is not that far off of the values in the current Texas case.

Historically, it seems that somewhere between zero and three dB off of circular is where the commission tends to draw the line. In 1983, the commission in a Memorandum Opinion and Order, colloquially referred to as "Ettlinger," refused to grant a proposal where the peak gain was 3 dB above circular. In this particular case, the applicant used a nominally non-directional, but optimized, antenna to meet the community of license coverage requirement while simultaneously serving a heavily populated area. In this case, although the applicant specified the antenna as non-directional, it instructed the manufacturer, in essence, to distort the pattern to achieve the desired 3 dB gain. That seems to be a pretty clear-cut case of overt attempts at distortion even if the values are less than those being bantered around in the current complaint.

The more problematic situation that could arise out of this whole proceeding is active enforcement of a somewhat arcane portion of Section 73.211(b)(1). That section states that unless your station is in Puerto Rico or the Virgin Islands, the maximum ERP in *any direction* is listed in the related table. This has the potential of being a huge game changer for nearly all stations licensed as non-directional. Instead of relying on the RMS gain of the antenna to determine the effective radiated power, licensees would have to consider the peak gain of an antenna. This would require each and every antenna to be range tested or scale modeled to determine the actual gain so as not to run afoul of the rules. The result is that new TPO values could be half of what would be expected normally.

As of writing, the Texas case is still pending, with the response to the show cause order due about press time. Some of the pleadings in the case indicate that the complainant may have also engaged in similar tactics of pattern distortion. Quite honestly that would not be earth shattering, as I would wager the trajectory of a rotating deceased feline on the floor at the recently completed NAB Show would intersect no less than a half-a-dozen similar dudes. That being said, I am anxiously awaiting to find out if this current case throws open Pandora's Jar (Yes — it actually was a jar), or whether the dogs roll over and go back to sleep.

Ruck is a senior engineer with D.L. Markley and Associates, Peoria, IL.

NEWPRODUCTS

Cable crib | Reel-Axe

Reel-Axe Cable Cribs store and protect microphone cables. This system is intended to organize cables, as well as protect them from damage. In order to store a cable, drop a connector into the opening and spin the reel; the cable will follow. When you reach the end, simply "snap" the trailing connector into place to fasten it. In order to unwind the cable: un-snap the trailing connector out of its groove and spin the reel.

reel-axe.com

Microphone preamplifier | Harman

Harman is now shipping its dbx 676 tube microphone preamp channel strip. A vacuum tube-based microphone preamplifier, the 676 offers sound-tailoring options. The dbx 676 uses a high-gain, Class A tube preamp section based around a 12AU7 vacuum tube that can be adjusted to either sound clean or dirty and full of harmonic character. The 676 uses the compressor/limiter design from the dbx 162SL along with a three-band parametric EQ. It adds a post-tube attenuation control. The preamp section also has 48 V phantom power, 20 dB pad, phase reverse and an 80 Hz low-cut filter. The dbx 676 offers 1/4-inch and XLR inputs and outputs, a front-panel instrument input, a side chain insert and a VU meter. An optional digital output card is available.

dbxpro.com

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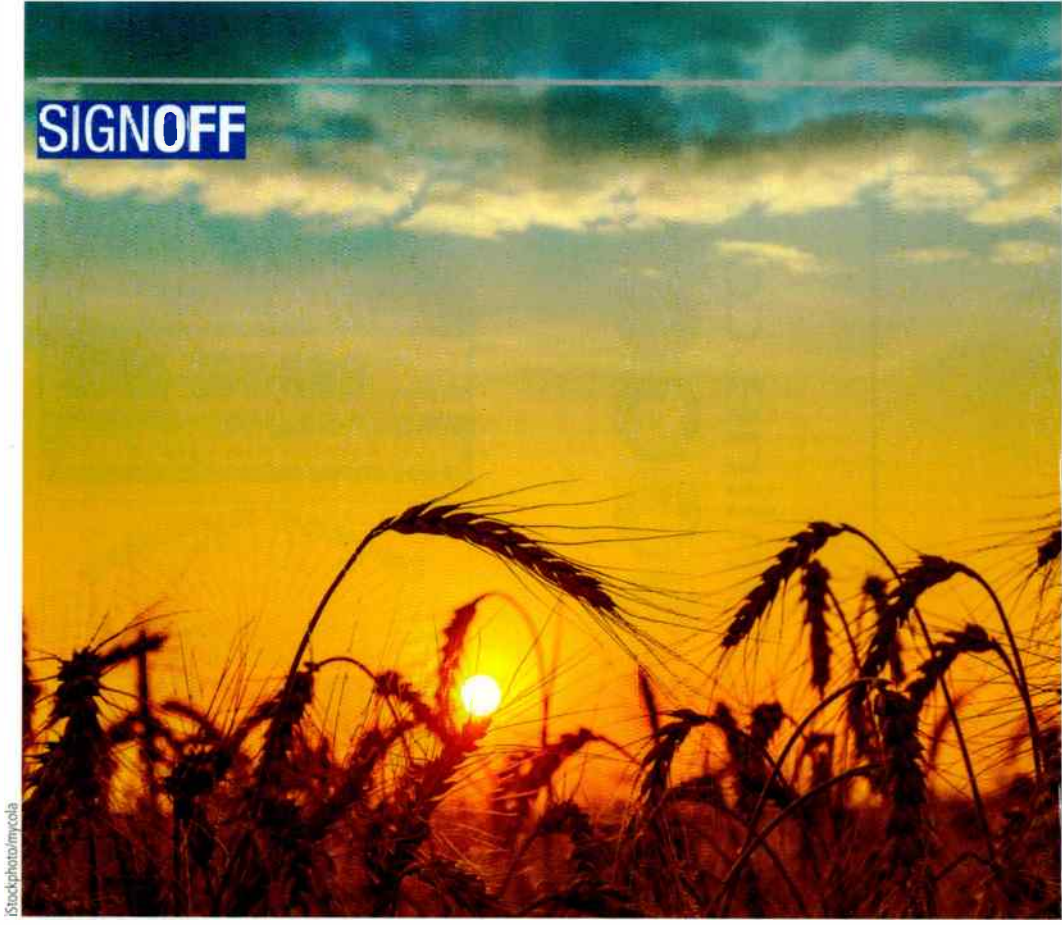

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Understand Product Life Cycles

by The Wandering Engineer

In the 1930s, the price of wheat went up as markets, and the means to get products to consumers, improved. Farmers' reaction was to plant more. As the supply exceeded demand and the price of wheat dropped, they learned the answer was not always "plant more."

It is tempting to see an increase in production as the answer to both high and low demand; it takes a lot of courage to moderate that cycle. Unfortunately, that courage and vision often comes only after a dustbowl.

Conversations and movements about rejuvenating broadcasting usually center on making it look and sound better and creating *more* of it.

In order to assess where our business and technology are in their life cycle, we should ask these questions: "If there were no radio today, would we invent it? If so, would it look like it does now?"

In the 1930s, the country was in the grip of its worst economic depression and a massive ecological disaster, but radio was proliferating.

If you lived on a dustbowl-era farm, when the sun set, you could search for WLS' Barn Dance, WSM's Grand Old Opry, WOR's world reports and big bands. For the price of 200-feet of wire, a very expensive radio and even more expensive batteries, a wind (or some other) charger, you could hear the world. If you were lucky, there might be enough of a ground-wave signal from a Kansas City, Omaha or Denver to get daytime service.

The solution to fill these service gaps, of course, was to create more stations. Today, the same rural farms would find about a hundred over-the-air stations to choose from. There are so many services that most have a fraction of a percent of their listeners tuned-in at any time. Even the most popular stations seldom see double-digit ratings.

With a good AM radio and 200-feet of wire antenna, it's often easy to count 20 stations running the same talk show. With the exception of some places in the desert Southwest, there are 40 to 70 clean signals on a typical FM car radio. Usually, there is a choice of about a half dozen of any popular genre. Add HD secondary services and we have at least half again as many services. Add satellite and we double or triple the number of services. Throw in an Internet streaming option and there is no real limit on how many services are available.

This growth in services and the dilution of audiences was pretty steady until satellite, cable and digital technologies rather recently catapulted broadcasting into exponential service growth. The Internet is beginning to move us into hyper-exponential service growth.

In a growth industry, it is prudent to produce more to take advantage of demand. Then, as the demand is satisfied and the value drops, the industry must moderate and produce more variety.

The radio industry is probably experiencing its dust bowl. This is not the end of the world or the industry, but the business may be reaching or (has reached) maturity. It may be that for free-over-the-air broadcasting to be healthy and sustainable, there should be a lot less of it on the air.

Nonetheless, there is a great argument that a high-power, low-cost to the consumer broadcast service would be worth some allocation of spectrum to serve everyone in time of emergencies and those who, for whatever reason, elect not to receive content via the Internet, satellite or cable.

We all know that there will be change, but we often don't foresee just how quickly it can come, or how absolutely disruptive it can be. Or how counterintuitive the inevitable outcome can be. 0

The Wandering Engineer is an industry stalwart who has been in broadcasting since the days of Marconi and Tesla. He gives his thoughts on the current state of broadcast engineering and the broadcast engineer.

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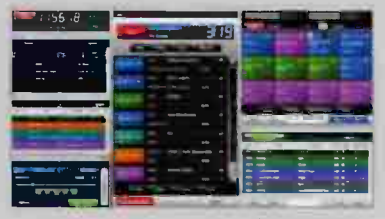

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