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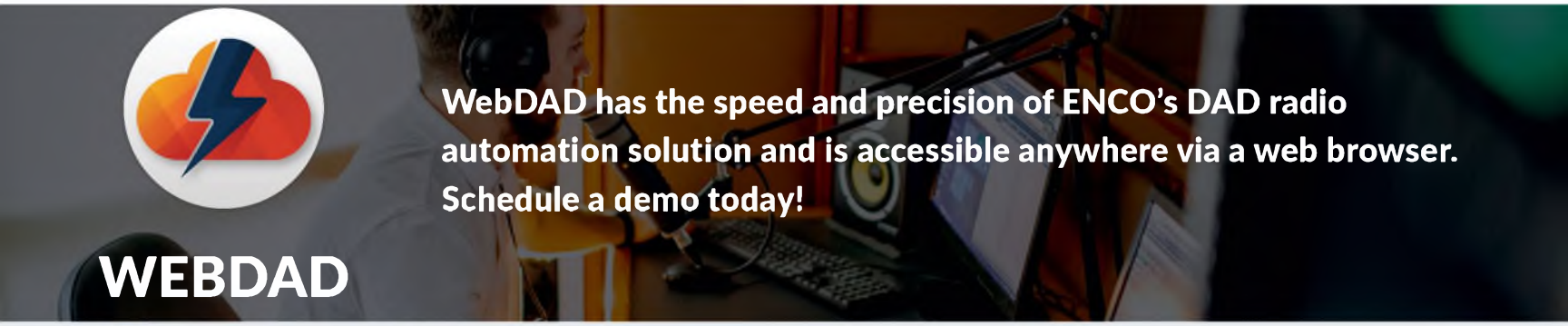
Workbench

Bobcats, batteries and how to dodge annoying Windows updates.

iHeart leaps into the metaverse

Pittman and crew get going with Fortnite and Roblox.



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CONTENT
Managing Director, Content & Editor in Chief Paul J. McLane, paul.mclane@futurenet.com, 845-414-6105
Content Producer & SmartBrief Editor Elle Kehres, elle.kehres@futurenet.com
Technical Advisors Thomas R. McGinley, Doug Irwin
Technical Editor, RW Engineering Extra W.C. "Cris" Alexander

Contributors: Susan Ashworth, David Bialik, John Bisset, Edwin Bukont, James Careless, Ken Deutsch, Mark Durenberger, Charles Fitch, Donna Halper, Alan Jurison, Paul Kaminski, John Kean, Gary Kline, Larry Langford, Mark Lapidus, Michael LeClair, Frank McCoy, Jim Peck, Mark Persons, Stephen M. Poole, James O'Neal, John Schneider, Dan Slentz, Dennis Sbattman, Randy Stine, Tom Vernon, Jennifer Waits, Steve Walker, Chris Wygal

Production Manager Nicole Schilling
Managing Design Director Nicole Cobban
Senior Design Directors Lisa McIntosh and Will Shum

ADVERTISING SALES
Senior Business Director & Publisher, Radio World
John Casey, john.casey@futurenet.com, 845-678-3839
Publisher, Radio World International
Raffaella Calabrese, raffaella.calabrese@futurenet.com, +39-320-891-1938

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Senior Vice President Group Elizabeth Deeming
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Chief Executive: Zillah Byng-Thorne
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Magic of the mind

A Nevada morning personality helps students embrace the power of radio

Paul McLane
Editor in Chief

"War of the Worlds," the classic Martian invasion program produced by "The Mercury Theatre on the Air" and directed and narrated by Orson Welles, remains a staple for lovers of radio and theater of the mind.

Tom Ray, a consultant and longtime friend of Radio World, told us this fall about a new production involving one of his radio clients.

Sandy Beeler, morning personality at KHIX(FM) in Elko, Nev., owned by Global One Media, is also vice president of Ghost Light Productions, a nonprofit theater company in that community.

She got the OK from the management of KHIX to put together a show with the Elko High School Theater Department to create some Halloween magic.

"I love getting to work with kids in theater," said Beeler. "They are eager and enthusiastic and honestly just the best and most fun to work with."

After casting students through auditions, she led the audio production of an hour-long Halloween show that would air on Mix 96.7 and be streamed on its website.

"When we began rehearsals, I explained to them that [radio] is theater of the mind," said Beeler. "There are no cues on stage. We tell the story through nothing but the way we speak it. They were quick to understand, and some came to the next rehearsal with different character voices already. They picked up everything so quickly."

With the exception of a few commercially recorded effects, the young people also made their own sound effects for the program.

Jeanine Hoskins, Elko High School theater teacher and thespians advisor, told Tom Ray, "This has been an amazing and unique experience for my students. They have risen to the challenge of having to rely simply on their voices to convey emotion and expression. This opportunity proved to be not only a learning experience but a fantastic social one for the students. They really bonded and enjoyed their time in the recording studio."

I've had my own happy experiences in creating live and recorded radio drama with groups like the Crosley Radio

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Right
Sandy Beeler, second from right, with Elko High School students who participated in "The War of the Worlds" special.

Players in Indiana, Lean & Hungry Theater in Washington and Port City Playhouse in Alexandria, Va. So hearing about this kind of program is delightful to me.

I checked in with Beeler after the show aired.

"It went off with a bang, in a good way," she said.

"The town was abuzz about listening to the show. Everyone was commenting on the Mix 96.7 Facebook page about the upcoming evening and how they were going to tune in and listen."

They even had listeners from Florida to New York, California and Utah, writing in saying they'd read about the show on the station's site and were excited by it.

"I think the students were able to hear how their story came to life on a different kind of stage, and use that in their next endeavor into radio theater, if they choose to do this in the future. With just their imaginations and voice, some could see they could have maybe voiced it a bit different or used different inflections. It's a learning process for all, in the best way possible."

She hopes to organize more projects like this, to bring theater-plus-radio to more students and other schools.

"It's two of my favorite things coming together, and I love seeing everyone getting involved with it. Magic of the mind!" RW

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MADE IN THE USA

iHeartMedia expands into the metaverse

Tokens, immersive gaming, podcasts and digital concerts are part of iHeartLand

Writer

Randy J. Stine

RW's longtime lead news contributor wrote about problems with wireless EV charging in the Nov. 9 issue.

Above
"Cranking 90s" in iHeartLand on Fortnite is a building game where users compete to be the first to the top.

iHeartMedia hopes to leverage its substantial audiences to help grow its presence in the metaverse. It promises a literal "whole new world of enhanced engagement" through interactive performances and immersive game play.

Broadly speaking, the "metaverse" is a term for an online digital world where people can engage with different brands and experiences. What that virtual world might become someday is still being figured out; but for now, the term usually refers to "the hypothetical virtual world enhanced by virtual reality and augmented reality," one industry observer said.

"Think of the metaverse as a collection of 3-D worlds fused together for the purposes of connecting with a larger audience."

There are skeptics who worry the term is being thrown around recklessly and that the metaverse is a long way from delivering on its promise. (Just Google "Facebook metaverse" and you might see headlines like "Facebook's metaverse is an empty, sad and unpopular flop.")

What iHeart has created is iHeartLand, part gaming and part entertainment. It is found on Fortnite and Roblox; but the company is thinking beyond that. There are multiple of layers to it, the company says, positioning itself to be ready to meet audiences in whatever future metaverse iterations come along.

Naming rights

"Our goal is to meet audiences where they are while delivering innovative, incredible programming to constantly challenge ourselves to take entertainment to the next level," said Conal Byrne, CEO of the iHeartMedia Digital Audio Group.

iHeartLand features a calendar of music and podcast performances at State Farm Park — yes, they sold the naming rights — that give fans a chance to play and interact with

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shows and artists in new ways. For instance Roblox users can become a music tycoon, according to the company's promotional material.

iHeartMedia promotes iHeartLand as a destination dedicated to bringing fans closer to big stars through gameplay. "iHeartMedia in expanding our engagement with our users," Byrne said.

The company has plans to host 20 major events over 12 months on Fortnite. It kicked off the virtual schedule hosting a Charlie Puth concert in September. Other artists scheduled for concerts include Ariana Grande and Travis Scott.

Observers say the extension of iHeartMedia's brand and activations to Fortnite and Roblox comes at a time when entertainment and media companies are accelerating their plans to build a space in the online digital world.

The metaverse "is such a natural fit for iHeart to integrate on-air radio content and talent," said veteran programmer Buzz Knight, former executive VP of programming at Beasley Media.

"The potential for iHeartLand is massive if they can be committed to the large investment of time and money and figure out a seamless way to integrate with their existing ecosystem."

Producer and media observer Evan Shapiro, in an interview with the NAB Amplify website this fall, identified the four major segments of the media economy as audio, video, gaming and social, all of which figure into iHeart's plan. Shapiro calls it the "media universe."

"Natural progression"

As for the metaverse, it has become an all-encompassing expansive term, says iHeart's Byrne, but by iHeart's definition it can mean at least three things: "Web2, which is the internet of today and includes Fortnite and Roblox and gaming platforms. Then Web3, which is immersive and built on blockchain technologies and includes the likes of Sandbox. There is a lot of interest in NFTs. Web3 has very small audiences so far but a lot of potential.

"The third version is augmented reality, and by many people's definition it's the real metaverse. And overlaid on the real world. That's the future."

iHeartMedia's expansion into that first layer of the online virtual digital world is a natural step, Byrne says, considering the amount of content it generates and the number of personalities it employs.

"A move to the online virtual programming space is a natural progression. The reason we want to start there, and it's just a start, is because iHeart is a collection of a lot of things. We are a collection of broadcast talent and influencers and entertainment that is a superpower. We have some of the best story tellers and conversation makers in all of media.

"The second thing we are is a mass-reach media company. We have almost a thousand radio stations and the iHeart Podcast Network with just huge numbers of podcasts downloaded each month. When we see places that are growing and expanding quickly, and Fortnite and Roblox are two such platforms, they are becoming mass-reach platforms, and we decided we want to be there with our brand," Byrne said.

Above
In iHeartLand on Roblox, each user gets a simple music studio to personalize. "From there, they will build their way towards a music empire by searching the streets of iHeartLand to collect sound energy to deposit back at their studio."

iHeart reached out to Fortnite and Roblox in the fall of 2021 and began brainstorming about what iHeart would look like on those platforms.

iHeartLand looks different in the two platforms, Byrne said, with each carrying its "own distinctive style look and feel."

iHeartLand is more than a token-based economy on Roblox, according to Byrne, though the gaming neighborhood does have iHeartBucks.

For instance, upon arriving to iHeartLand on Roblox, "each user will be given a simple music studio to personalize. From there, users will build their way towards a music empire by harnessing the power of audio and must search the streets of iHeartLand to collect sound energy to deposit back at their studio."

An iHeart media release continues: "The sound energy powers the studio while generating listeners and iHeartBucks, which are used in-experience to upgrade their studio with cool equipment, playlist programming, studio pets and more."

iHeartLand minigames on Fortnite include Cranking 90s, Speed of Sound, Leap of Faith and others, according to the promotional material.

"Players can head inside the iHeart building to view a small-scale overhead map of the island to find their way throughout iHeartLand, a broadcast recording studio and iHeart's famed radio Tuning Tunnel found in its actual New York City headquarters."

iHeart CEO Bob Pittman recently told Inside Radio: "Tokens finally give us a way to build a really robust loyalty program."

The broadcaster worked with Atlas Entertainment on development of its Fortnite island and the game development studio known as The Gang Stockholm for its Roblox iHeartLand design.

iHeart hadn't released public data about the number of visitors to its online digital world as of this writing,

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but after opening in Roblox on Sept. 14, iHeartLand had generated 1.5 million visits through the end of September, according to Digiday, an online magazine that reports on digital media.

The demographics for Fortnite and Roblox are very young, according to iHeart, though the audience is aging.

"For example, when we started building iHeartLand in Roblox, two-thirds of their audience was 16 or younger. That's incredible. Of 200 million Roblox users a month, two-thirds 16 or younger. Now, that has aged up to over 50% of users are over 16. So it's aging up quickly. We have to program concerts and gaming for the appropriate age group. Not just Gen Z, but Gen Alpha. That makes it a fun challenge," Byrne says.

iHeart hopes to shape the next generation of the metaverse by offering more immersive experiences.

"I think this kicks off a bona-fide new platform for us to eventually successfully monetize. We want to do a lot more concerts. We are also super interested in the metaverse in how it applies to the real world, or augmented realities and of course Web3. There is real power there in how they operate with tokens and currencies."

Byrne says a cross-department team at iHeart is overseeing the metaverse project, from product and business development to in-house product engineering and design teams.

Sponsors of iHeartLand, including State Farm and Intel, are interested in iHeart's ability to launch cutting-edge innovation with mass-reach media that deliver audiences, Byrne said. "This gives advertisers the ability to crack a new space before their competition."

Other efforts

Radio World invited Cumulus, Beasley Media Group and Audacy to share their plans for the metaverse.

Cumulus declined to comment on any metaverse plans.

Audacy Chief Digital Officer J.D. Crowley provided a statement to Radio World: "Like all new technology and distribution opportunities in the past, Web3 and the metaverse will both open new opportunities for us to engage with our fans and have the potential to unlock new lines of business.

"Right now, we're all in a test and learn phase, and we have a number of pilot activations in development, from our events, to brand partnerships, to content distribution. And like with any new space, we'll see what resonates with consumers and lean in accordingly. The question is not if, but when and how."

A Beasley spokeswoman said the broadcaster is "currently exploring potential opportunities in the metaverse" but declined to discuss specific plans.

"We see the value and potential opportunity for audiences in the radio/audio industry," she said.

Newswatch
Jim Wulliman, Former SBE Leader, Dies at 98

James Wulliman, a past president of the Society of Broadcast Engineers who played a key role in the beginnings of its certification program, died in November.

He was president of SBE in 1973–75 and is credited with creating the certification initiative in 1977 to help document and elevate the professional credentials of broadcast engineers in their careers. He was the director of the certification program and its chairman for 20 years.

He was a charter member of the society, one of the first 300, and later became an SBE Fellow and Life Member.

According to an obituary published by the Green Valley (Ariz.) News, Wulliman died on Nov. 8 at age 98.

He was born in South Dakota but grew up in Illinois, where he worked for radio station WDZ(AM) in Decatur.

He attended Northwestern University and served in the army in Europe in WWII, and in 2015 he was awarded the French Legion of Honour Medal for excellent military conduct during the war.

According to the obituary, Wulliman was instrumental in launching WCNB(AM) in Connersville, Ill. He started a TV station in Decatur, and later led design and construction of two public TV stations in Milwaukee, serving as their chief engineer and assistant director of operations.

Wulliman later became director of engineering for the Journal Broadcast Group, including WTMJ(AM), WKTI(FM) and WTMJ(TV), Milwaukee, a post he held for many years. He was also the first president of Milwaukee's SBE chapter.

He was only the second recipient of the SBE's Lifetime Achievement Award, given in 1995, and he was inducted into the Wisconsin Broadcasting Museum Hall of Fame in 1998.

In 2011 the SBE honored him again by naming its annual Educator of the Year award after him. The award recognizes a member who is dedicated to the education of broadcast engineers through personal writings, teachings, programs and employment and who furthers the goals and objectives of the society.

After retirement, Wulliman and his wife Virginia moved to Green Valley, Ariz.

In his obituary, his family wrote: "We are proud to know that he was liked and respected as not only technically knowledgeable, but a 'quiet manager' who was friendly, professional and supportive of his engineers' own growth in the field."

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What's on your RF site "must check" list?

Also, hints for disabling those pesky Windows updates

John Bisset
CPBE

The author has spent over 50 years in broadcasting and is in his 32nd year writing Workbench. He handles western U.S. radio sales for the Telos Alliance and is a past recipient of the SBE's Educator of the Year Award.

Given the greatly improved reliability of broadcast equipment, it's easy to postpone routine transmitter site visits. This is especially true if you are a single engineer handling multiple markets with multiple sites. There's just not enough time in the day.

To help the engineering community focus on what matters, I'd like you to email me and list three items that you consider "Must Checks" when you visit a transmitter site. What's most important to check? But also, what's obscure or easily overlooked — like replacing the memory "keep alive" batteries in some transmitters (or checking for bobcats on the roof of your building)?

Shoot your top three to me in an email to *johnpbisset@gmail.com*. Include a picture if you have one, in the highest resolution available. And for those who are SBE-certified, remember that having your tips published in an international trade publication like Radio World counts toward your recertification credit.

Above Crawford Broadcasting Director of Engineering Cris Alexander found this furry trespasser on video from a security camera at Tower No. 2 at KBRT Los Angeles.

Right The Battery Daddy is a $20 solution to the problem of loose batteries. You can store all kinds in this double-sided case.

Good cell coverage

When was the last time you went to grab a battery but couldn't find it or had to scrabble around in your junk drawer or tool bag?

Not a lot of fun. Here's an organizational solution.

Battery Daddy is a storage system to organize and protect all types of batteries. Its double-sided design stores and organizes up to 180 batteries, but only takes up the space of a laptop.

In addition to keeping the batteries organized and protected against accidental discharge, the clear case tops let you monitor your inventory. You'll never be stuck needing "just one more AAA cell." The Battery Daddy comes with a tester so you know what you're grabbing is fresh.

Note that Battery Daddy is not furnished with batteries, it's only an empty case, but it costs only $20. Search "Ontel

Battery Daddy" on Amazon. Scroll the results to see other sizes and options.

Updates on your terms

Paul Sagi, who reads Workbench in Kuala Lumpur, told you in May about a command to obtain a list of system information, including MS Windows updates.

Windows updates can be a nuisance; they sometimes introduce bugs or occur at the worst times (such as when the PC is needed), and can't be delayed or interrupted. Paul calls it "Microsoft being dictatorial."

There is a workaround, though. Paul discovered *http://sordum.org*, where you will find a program called Windows Update Blocker or WUB.

You'll need to get the latest version, as Microsoft keeps changing its tactics, but Sordum updates WUB to deal with those changes.

WUB has an editable config file, so Microsoft tricks (programs, tasks and services) that are not covered can be added to block them as well.

"You're playing the game on Microsoft's territory," Paul writes, "so they have the home field advantage, thus Windows updates are tough to control; but I have succeeded."

He had to do a lot of digging into Windows to defeat the automatic updates, including finding and disabling XML code that functioned as a timer.

To complicate things, Microsoft builds in multiple triggers for the updates, and all of them need to be defeated to make the updates cease. WUB helps a lot though by automating much of the difficult work.

To be fair, Paul notes that updates can be important for security. But they're lousy if they're buggy or disrupt station automation.

Make a new connection

As you will see in an upcoming Radio World studio ebook, audio over IP continues to take the industry by storm, especially in new facilities.

Above
The Battery Daddy includes a battery tester.

Left
A new XLR-to-terminal-strip adapter from American Recorder is a must-have for remote engineers or roadies.

But plenty of analog studios remain in service, and many remote engineers and pro audio technicians read this column too. With them in mind, I want to mention that American Recorder Technologies Inc., is shipping its new XLR Screw Terminal Adapter.

This three-pin XLR adapter allows integrators, audio/broadcast engineers and installers to make balanced XLR connections without having to break out the soldering equipment, which saves labor time and cost.

The adapters are identical to the pinout of a standard solder-type XLR male or female plug. They feature a three-position terminal strip, located at the back end of the adapter, allowing direct connections of wires, up to 16 AWG (American Wire Gauge). The terminal strip is numbered for connection identification: hot (2), cold (3) and ground (1). MSRP is $6.99 each. Contact your favorite broadcast supplier or visit *www.americanrecorder.com*.

Tips Please

Workbench submissions are encouraged and qualify for SBE recertification credit. Email *johnpbisset@gmail.com*.

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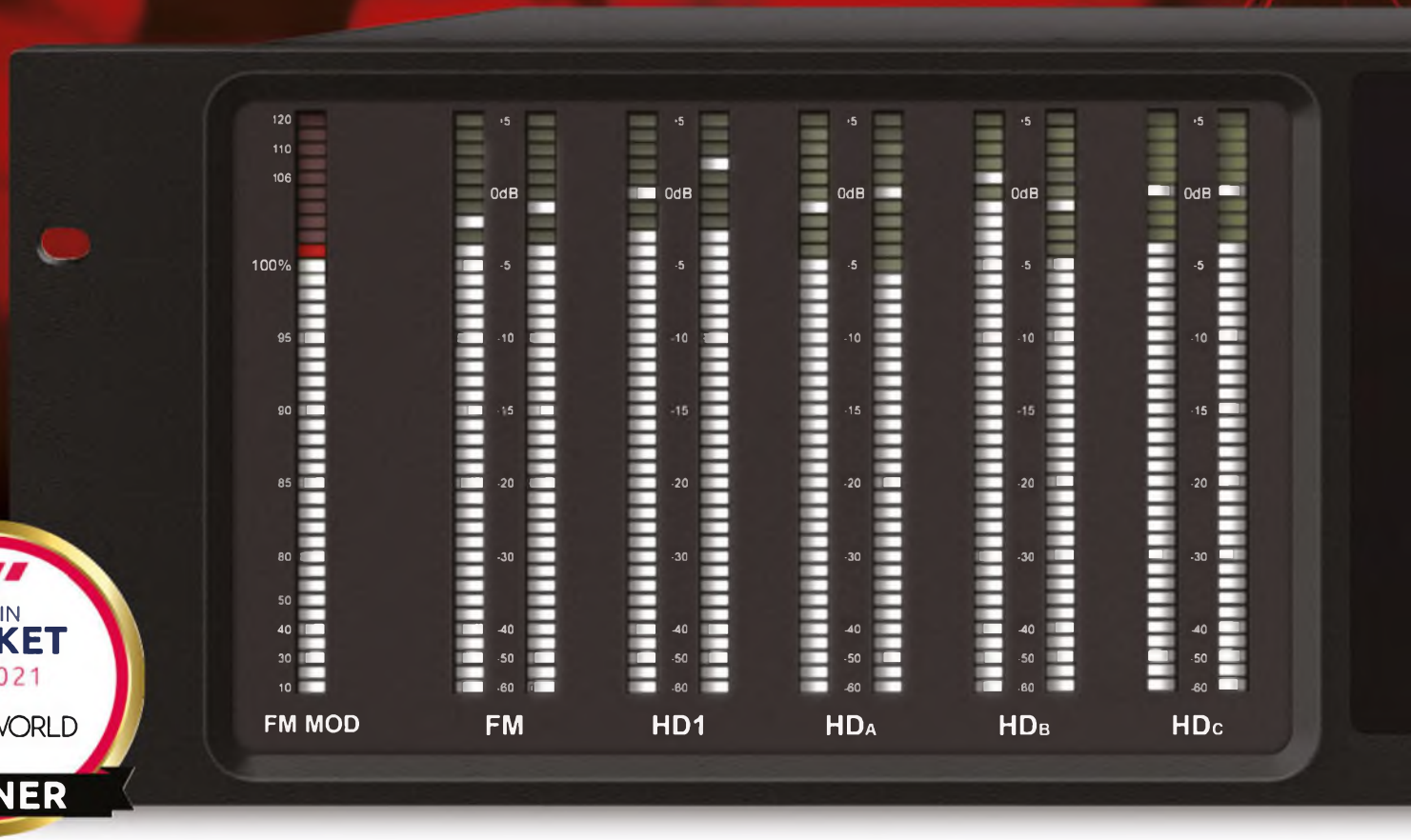

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John Schneider

The author has spent his career in broadcast technology development and sales, and is a lifelong radio history researcher. He has written numerous articles for Radio World. Email him at *jschneid93@gmail.com*.

WGY in Schenectady, N.Y., celebrated its centennial birthday this year, one of several dozen pioneer broadcasting stations that crossed the 100-year finish line in 2022.

Though all these stations are notable for their endurance and importance to the industry, WGY stands tall for contributing to the science of broadcasting, particularly in its first decade of its operation. For that reason Radio World is ending the year with this special photo essay about the station.

WGY began life as the flagship station of the General Electric Company, operating from G.E.'s massive campus in Schenectady. At that time, G.E. was a veritable cradle of radio technology, and WGY was nursed by some of the world's most capable engineers and scientists, among them Dr. E.F.W. Alexanderson, Dr. Charles Steinmetz, Irving Langmuir and A.D. Ring.

G.E. invested nearly $10 million in the 1920s for the study of RF propagation, transmitters and power vacuum tubes, and WGY was its field laboratory.

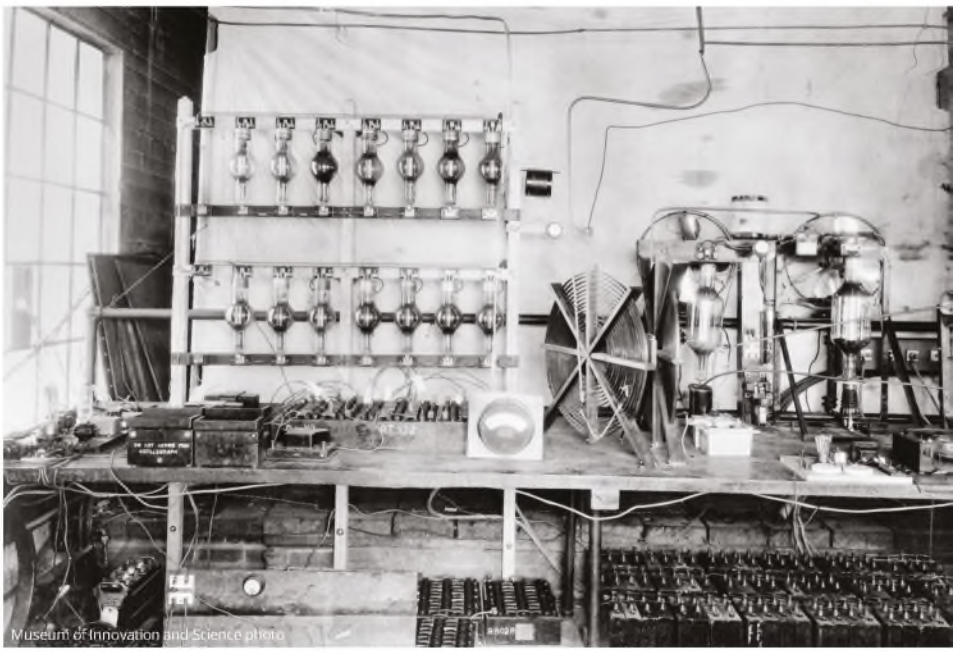
At the dawn of broadcasting, stations used telephone-mouthpiece microphones and wind-up phonographs to feed their programs to crude homebuilt transmitters. Early vacuum tubes were low-powered, unstable, expensive and short-lived.

That had all changed by the end of the decade, when stable, powerful transmitters, elaborate studio equipment and high-fidelity microphones were delivering quality programs to listeners. Most of these technological improvements were developed by just three companies: AT&T, Westinghouse and General Electric.

WGY, blessed with near-unlimited funding by one of the world's largest corporations, served as the laboratory where much of those technologies were tested.

Going haywire

WGY was birthed on Feb. 20, 1922, the 12th broadcaster in the country. Its two-room studio was on the fourth floor of G.E. Building 36, with a transmitter squeezed into the



Museum of Innovation and Science photo

Above
The original 1,500-watt transmitter went on in February 1922; its open breadboard configuration was modified as improvements were developed. Six modulator tubes are at left. The RF coupling network and a self-oscillating RF tube are at center. The three-phase DC power supply frame with six rectifier tubes is at right.

Right
April 1922, power was increased to 5 kW by adding another set of modulator and RF tubes. Storage batteries under the table provided lower DC voltages for tube bias and smaller tubes. Motor generators supplied filament voltages.

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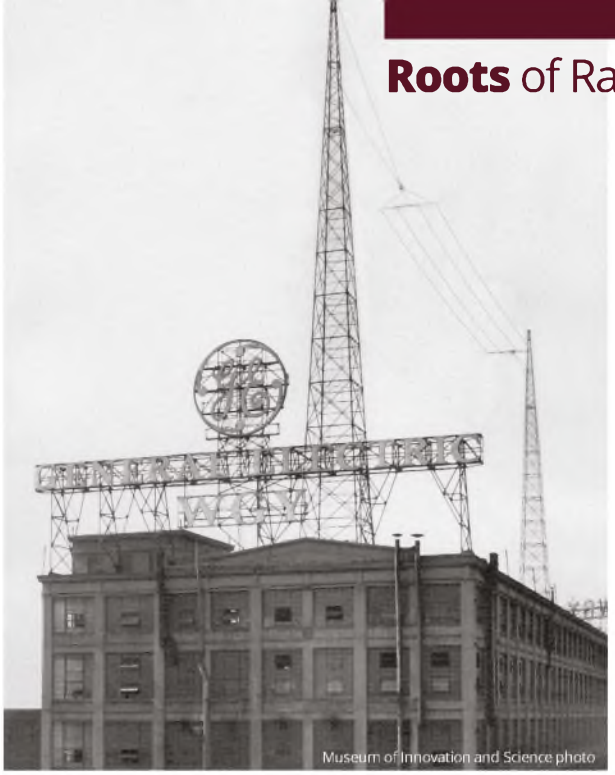


Museum of Innovation and Science photo

Author's collection

Right
In the first photo, WGY's first antenna is seen on the roof of General Electric Building No. 40 in Schenectady. The two 183-foot support towers were spaced 350 feet apart, and the flat-top horizontal antenna was 200 feet in length. Programs were high-quality. In the second image, Kolin Hager announces the performance of a harpist.

Below Left
Early broadcasting was plagued by annoying heterodyne interference caused by transmitters drifting off frequency. This limited the number of stations that could operate on a channel. General Electric solved this by adapting quartz crystal oscillators for use in transmitters. Instead of the usual self-oscillating high-powered RF stage, this required a master oscillator-power amplifier topology. Here, young General Electric engineer Andrew D. Ring displays G.E.'s first crystal oscillator system, placed into service at WGY in 1926.

Far Right
Workers assemble a 100 kW UV-862 power tube at the General Electric factory in 1927. The 5-foot-long water-cooled tube became the industry standard for high-power RF through the 1940s. The discovery of a method of sealing copper to glass was a milestone achievement.

elevator room of Building 40 a half-mile away. Two 180-foot towers and a flat-top antenna rose from the rooftop.

That first transmitter, capable of 1,500 watts (considered high power for the time) was a "haywire" contraption — open wooden frames supporting coils, wires and vacuum tubes. Dr. W.R.G. Baker, in charge of radio transmitter development, built the transmitter, and William C. White, head of the vacuum tube division, crafted the tubes.

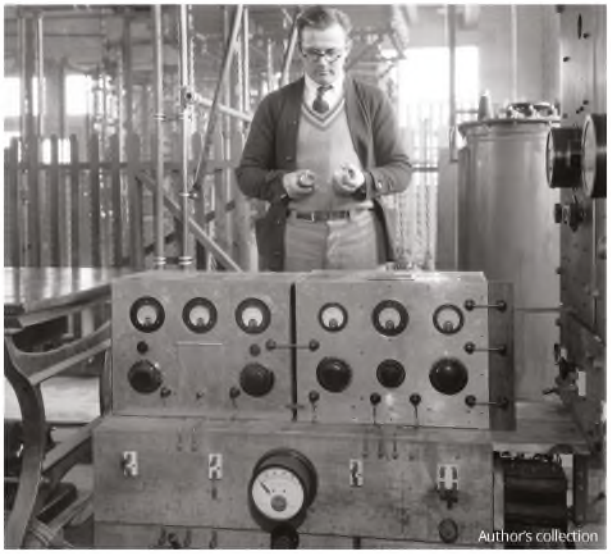
White later said, "It was a crude affair and, as we look at pictures of the equipment at that time, it is a wonder that it ever stayed together." Even after WGY went on the air, the transmitter was continually being altered as new circuits and tubes were tested.

Received across most of the eastern United States at night, WGY quickly drew attention for its quality programming.

Besides a regular schedule of live music, news and farm bulletins, WGY was the first station to experiment with radio drama, producing a new "radio play" each week. But although these programs were well-received by listeners, it was the behind-the-scenes experimentation in high-power transmission that is notable today.

Scarcely two months after its debut, additional tubes were added to raise the power to 5 kW. It was at that point they realized there was a limit to the size and power of glass tubes, and to how many of them could be operated in parallel without creating parasitic problems and a loss of efficiency. A better solution would be needed.

In 1924, the WGY transmitter moved to its current location in the Town of Rotterdam, then known as South Schenectady. Its new transmitter generated 10 kW using a single experimental 20 kW UV-207, the first practical water-cooled tube. This higher power was also made possible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Left
To demonstrate its size, the photographer had Kathryn Carroll stand next to one of G.E.'s UV-862 RF power tubes. The water-cooled copper anode is at the bottom, with the glass-enclosed plate and grid assembly at the top.

Below
This was the modulator of WGY's experimental 100 kW transmitter in 1927, using three UV-862 tubes. Engineer A.D. Ring, shown, went on to become assistant chief engineer of the FCC before starting a well-known engineering consulting firm.

by another G.E. development, the mercury vapor rectifier tube, which allowed the generation of higher DC voltages.

Even though 10 kW was the highest broadcasting power achieved to that time, this did not weaken G.E.'s quest for still more power. After all, G.E. manufactured dynamos capable of thousands of kilowatts, and so the task of creating higher-power vacuum tubes was not intimidating.

Proving ground

William White and his development team continued their push for bigger tubes having higher power, longer life and better efficiency.

"WGY was never too much of a showplace because we were always trying something new in the way of new types of tubes," he said. "Some of those were screen-grid tubes, thoriated filament tubes and mercury vapor rectifier tubes. Our own station WGY was very often a proving ground where we tried out new things."

Work began to develop a 100 kW water cooled tube, and on July 18, 1925, WGY became the first station anywhere to broadcast with 50 kW. The test was coordinated with the Department of Commerce and widely publicized, and thousands of letters were received praising the reception quality.

More testing followed, with transmissions taking place during early morning hours. On Oct. 3, WGY was allowed 50 kW operation on Saturdays and Sundays, and, after several months with no significant interference complaints, authorization was given to operate at 50 kW full time on May 8, 1926.

In 1928, GE started accepting outside orders for its 100 kW UV-862 tubes. This imposing device was a copper-and-glass cylinder measuring 5 feet in length and 6 inches in diameter, costing over $1,000 each in 1930s dollars (roughly $16,000 today). Both it and the 20 kW UV-207 tube were manufactured in substantial quantities, becoming the principal higher-power tube types in use through the end of World War II.

As a next step, G.E. finalized the design of a 50 kW transmitter, the popular 50B, using two UV-862 tubes in its final amplifier. Most of the prestigious clear-channel stations in the U.S. adopted it, and many of these rigs remained on the air into the 1950s.

The first unit was installed at WGY, and then G.E. built more for WTIC, WEAF, KPO, KOA, WENR, WFAA and KFI. Westinghouse and RCA later manufactured the 50B for numerous other stations.

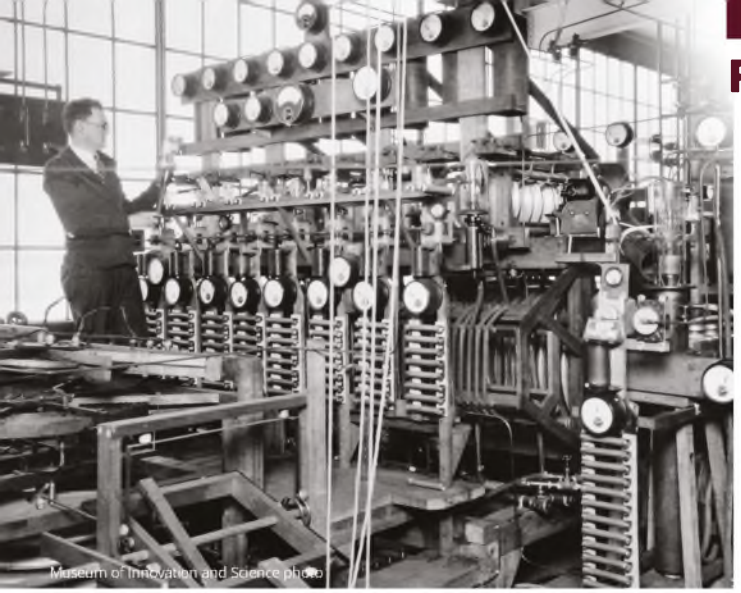
And still, the quest for even higher power continued as multiple UV-862 tubes were being paralleled for still more kilowatts.

WGY aired tests at 100 kW in 1927, 150 kW in 1928 and 200 kW in 1930. In 1928, WGY applied to the Federal Radio Commission for authority to broadcast at 150,000 watts, but its application was denied.

Nonetheless, the high-power technologies developed for those tests found a home when RCA accepted the task of building a 500 kW transmitter for WLW in Cincinnati, the most powerful broadcast transmitter ever made to that time.

With its high-power RF experience, G.E. was contracted to build the RF section and Westinghouse was assigned the modulator. G.E.'s RF design consisted of three independent 166 kW Class "A" power amplifiers connected in series to feed the antenna. This "monster transmitter" operated reliably at WLW from 1934 until 1939, when political

Museum of Innovation and Science photo



Left
WGY's first 50 kW transmitter, undergoing tests at the General Electric laboratories in 1926. A.D. Ring is holding one of the modulator tubes. One of the UV-826 final amplifier tubes can be seen at far right.

Right
In 1932, WGY placed the prototype of the model 50B, 50-kW transmitter into service. The final configuration, manufactured by both General Electric and Westinghouse and marketed by RCA, saw use at dozens of the country's highest-power stations.

pressures persuaded the FCC to rescind WLW's super-power experimental authority.

Even though most of the radio technologies that General Electric developed in those early years have since been superseded by modern solid-state and digital technologies, we can still marvel at the genius and commitment of those early engineers and scientists who advanced radio broadcasting from a crude experiment into a stable commercial and technical enterprise.

Today we recognize WGY for its role in this process, and for enduring as one of the country's preeminent broadcasters for a complete century. RW

RESOURCES:

*Oral histories: Irwin R. Weir, William C. White, Kolin Hager, and Walter Baker
*WGY History — a centennial article by WGY
Institute of Radio Engineers — Proceedings, 1923.
"Broadcasting" Magazine 10-1-36, 3-31-41
"Radio Age" Magazine, April 1922
"Radio News" Magazine, Oct. 1925
"Radio Digest" Magazine, Aug. 1925; Jan. 1926

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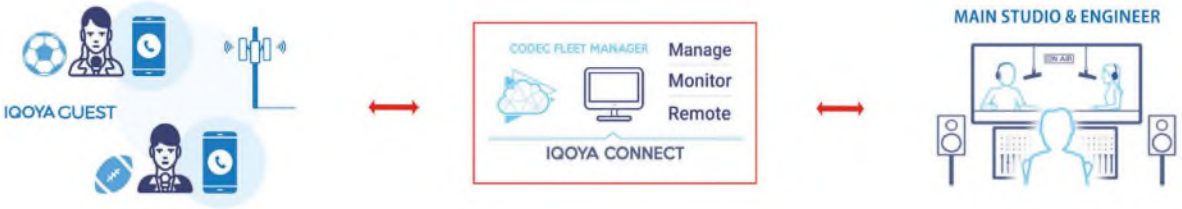

Writer

Wayne M. Pecena

CPBE, 8-VSB, AMD, ATSC3, DRB, CBNE

Member, SBE Education Committee

About This Series

This article is based on an excerpt from the Society of Broadcast Engineers CBNT/CBNE Study Topics webinar series, designed to assist those seeking SBE certification and to provide others a broad overview of IT as used in broadcast engineering. This webinar and many others are available to anyone for a modest fee, with members receiving a discounted rate and free to those with the SBE MemberPlus upgrade. Consider joining if you are not a member at *sbe.org*.

Tips for troubleshooting your network

Don't shoot from the hip, approach this challenge in an organized way

This is Part 7 of an eight-part series.

Resolving network issues is one of the most stressful situations that the broadcast IT engineer faces. It feels easier to pinpoint the root cause of an outright outage than a problem with performance degradation. Complaints such as the "network is slow" or the audio stream is buffering at times can prove far more challenging.

Troubleshooting of any system involves a few basic logical concepts or steps.

The IT certification organization CompTIA offers a six-step methodology that begins with a clear identification of the problem and ends with documentation of the outcome actions and findings. At all costs, you want to avoid a "shoot from the hip" approach or randomly applying whatever fix that might come to mind. This approach often leads to injecting new problems masking the original root cause.

The data flow layers of the OSI model provide an excellent structured approach. At the Physical or layer 1 the focus is on Ethernet cabling, which often accounts for the majority of problems in a network. Cabling issues can involve many variables, from improper installation to sub-par or inferior products being used, or post-installation damage. The network based upon Category 5e Ethernet cabling that works perfectly at 100 Mbps can fail when operated at 1,000 Mbps or GigE data rates.

A common installation parameter often overlooked is the maximum segment length. Whereas well known as 100m in length, the patch cables or jumper cables at the cabling ends are often overlooked in the overall segment length calculations.

Improper installation may also include running Ethernet cables parallel to electrical cabling rather than crossing electrical cables at a 90-degree angle to minimize any magnetic field interference to the Ethernet signaling. Kinks and sharp bends can also impact performance especially at 1 GigE data rates.

Use of the wrong connector or termination jack can cause performance issues, where a solid conductor twisted-pair cable is terminated with a connector designed for stranded conductor cable or a stranded conductor cable is terminated with a connector design for solid conductors.

There are RJ-45 connectors that are compatible with solid or stranded conductor cables, but are often more expensive. Gold-plated contact connectors will outperform

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lower-cost tin-plated contacts due to corrosion likely with the tin plating. It is also important to maintain the proper twist count per inch for the cable category when terminating.

Inferior products can include cabling that does not fully meet the category specifications of the EIA/TIA. The use of copper-clad aluminum conductors rather than solid copper conductors is a common method to reduce cable cost. Over time, the copper-clad aluminum cable is more likely to degrade and present problems due to oxidization of terminations.

When Power over Ethernet (PoE) is implemented, verify that the proper conductor gauge cable is used to support the wattage or current supplied by a PoE Ethernet switch to the powered device. Category 6 cables typically are constructed of 23-AWG conductors. PoE Power Sourcing Equipment (PSE) standards range from type 1 to type 4 supplying 15.4 to 90w respectfully.

A handheld Ethernet cable test set is the practical approach to ensuring confidence in proper Ethernet cable wiring, total segment length and PoE current delivery. Capabilities of the test set can range from basic cable verification to cable qualification test.

Beware the mismatch

Once you have ensured that the physical cabling is not at fault, it's time to verify the Data-Link or layer 2.

A common cause of performance degradation is often attributed to a duplex mismatch between an Ethernet switch port and a host. A duplex mismatch results when the two devices (Ethernet switch port and connected host) are not configured the same. The mismatch can occur due to a manual configuration mistake or failure of the auto-negotiation process, creating late collisions and resulting in errors.

An advantage of a managed or a web managed Ethernet switch is the ability to view individual switch port Cyclic Redundancy Errors (CRC) to verify there are no collisions. Resolution is typically accomplished by hard-setting either or both devices to a common configuration such as full-duplex rather than trusting the auto-negotiation process.

As your logical troubleshooting reaches the Network layer 3 and above, it becomes necessary to "see" the interaction between devices or "see the data on the wire." A protocol analyzer such as Wireshark is essential to capture real-time application data between hosts. Wireshark is an open-source packet analysis software tool that I consider the oscilloscope of network communications.

Its full scope and capabilities are well beyond the scope of this article. However, the use of capture or display filters is a useful practice to narrow the captured or displayed packet data.

A capture filter will minimize the amount of data captured to those host devices defined by the filter. A display filter simply limits the data displayed. An IP address filter can be used to see the interaction of a single host device with other devices. Due to the amount of network data typically captured in just a few seconds, a filter becomes essential to focus upon a specific area of interest as you essentially search for the "needle in the haystack."

ip.addr==50.31.202.196

No.	Time	Time Delta	Source	Destination
1	18:46:50.028593	0.000000	50.31.202.196	192.168.1.112
2	18:46:50.075855	0.047262	192.168.1.112	50.31.202.196
3	18:46:50.237464	0.161609	50.31.202.196	192.168.1.112
4	18:46:50.237464	0.000000	50.31.202.196	192.168.1.112
5	18:46:50.237578	0.000114	192.168.1.112	50.31.202.196
6	18:46:50.507802	0.270224	50.31.202.196	192.168.1.112
7	18:46:50.507802	0.000000	50.31.202.196	192.168.1.112
8	18:46:50.507879	0.000077	192.168.1.112	50.31.202.196
9	18:46:50.885314	0.377435	50.31.202.196	192.168.1.112
10	18:46:50.885314	0.000000	50.31.202.196	192.168.1.112
11	18:46:50.885364	0.000050	192.168.1.112	50.31.202.196
12	18:46:51.146623	0.261259	50.31.202.196	192.168.1.112
13	18:46:51.146623	0.000000	50.31.202.196	192.168.1.112
14	18:46:51.146699	0.000076	192.168.1.112	50.31.202.196
16	18:46:51.441298	0.294599	50.31.202.196	192.168.1.112
17	18:46:51.441298	0.000000	50.31.202.196	192.168.1.112
18	18:46:51.441375	0.000077	192.168.1.112	50.31.202.196
19	18:46:51.792590	0.351215	50.31.202.196	192.168.1.112
20	18:46:51.792590	0.000000	50.31.202.196	192.168.1.112
21	18:46:51.792667	0.000077	192.168.1.112	50.31.202.196
22	18:46:52.076600	0.283933	50.31.202.196	192.168.1.112
23	18:46:52.076600	0.000000	50.31.202.196	192.168.1.112
24	18:46:52.076676	0.000076	192.168.1.112	50.31.202.196
25	18:46:52.413450	0.336774	50.31.202.196	192.168.1.112
26	18:46:52.413450	0.000000	50.31.202.196	192.168.1.112
27	18:46:52.413528	0.000078	192.168.1.112	50.31.202.196
28	18:46:52.664644	0.251116	50.31.202.196	192.168.1.112
29	18:46:52.709534	0.044890	192.168.1.112	50.31.202.196
30	18:46:52.936642	0.227108	50.31.202.196	192.168.1.112
31	18:46:52.936642	0.000000	50.31.202.196	192.168.1.112
32	18:46:52.936720	0.000078	192.168.1.112	50.31.202.196
33	18:46:53.164371	0.227651	50.31.202.196	192.168.1.112

Above
Wireshark display with time delta column added.

The Time column of the default Wireshark display indicates when the packet was captured. The default is the number of seconds since the capture began, but can be changed to display clock time in various formats including sub-second resolution.

A useful approach to troubleshooting performance issues is to add a "Time Delta" column to the default Wireshark column arrangement. This approach may make significant response delays or Transmission Control Protocol (TCP) retransmissions between host devices of interest more apparent.

Keep in mind that accurate network documentation can also be a timesaver in network troubleshooting and might be essential for someone not familiar with the network environment involved.

WUKY Gets a New Transmission Chain

Radio station WUKY(FM) at the University of Kentucky completed a major RF project in October. The update includes new main and aux HD Radio transmitters and a new building for its backup site.

Distributor Broadcast Depot provided key equipment, as recommended by the station's consulting engineer William Smith. The hardware list includes a Nautel GV30N-D transmitter for the main site and Nautel GV10D for the auxiliary site.

Both sites have Broadcast Devices RF Site Controllers. The station is using the new Inovonics 551 HD Radio mod monitor and Omnia Enterprise 9s processing. The main STL is a Moseley NX-Gen 6 GHz system, with MPX nodes used as backup. Myat and Altronic Research also provided components. JM Stitt & Associates Inc. performed the transmitter and final proofs.

"WUKY found themselves embracing state-of-the-art digital technology to bring the transmission facility into the 21st century," said Mary Schnelle of Broadcast Depot. The project follows a digital upgrade on the studio side in 2018.

She said the project experienced some longer-than-normal lead times due to supply chain issues and having to wait for delivery of a new building for the backup site, which is at the studio location.

The station's roots go back to 1921. It was one of the stations that helped create National Public Radio. It switched on HD Radio in 2007.

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Above
A tweet by Elon Musk as seen on a phone in Poland in April.

Radio, do you understand your assets?

It's an open question whether Elon Musk did when he made a bid for Twitter, but you don't have to make the same mistake

I laughed out loud when I read an article headlined "Welcome to Hell, Elon — You Break It, You Buy It" written by Nilay Patel on The Verge website.

"Twitter is a disaster clown car company that is successful despite itself," Patel wrote, explaining that Twitter's most valuable asset is neither its operation nor its relatively simple technology but a thing that grows only by running amok with reputation-destroying compromises.

"The asset is the user base: hopelessly addicted politicians, reporters, celebrities and other people who should know better but keep posting anyway. You! You, Elon Musk, are addicted to Twitter. You're the asset. You just bought yourself for $44 billion."

What are our assets?

Hooray for radio, whose assets are tangible and sane!

But we have to identify our assets to maintain and improve them. Not everyone will agree with this list, which is fine, as long as it encourages you to think long-term about identifying what you need to concentrate on to build success.

Asset Number One: Local Personalities. Age-old debate! Must personalities live in your city to be "local"?

I believe strongly that they do. Voice-tracking from some faraway destination ultimately sounds generic and it's nearly impossible for those voices to sound meaningfully involved with

local community activities and events. Appearances and remotes are too infrequent or even absent.

Sure, that voice-tracker from another town may sound more professional, especially in small or medium markets; but authenticity and local interaction are far more important.

Once you have invested in a personality, make sure they're happy and your relationship solid. Seismic change in a key morning show can tank an entire station. Often new program directors will judge a morning show as literally over-rated, not realizing the importance of longevity in the marketplace.

Asset Number Two: Local Advertisers. With programmatic buys dominating, who's paying attention to the local retailer? Local media remains relationship-based, whether directly or through your client's agency.

This requires multiple touch points each month — contact that went poof during the pandemic. Untenable in the long run, if you find your salespeople still zooming it in, it's time to cut that cord. I'm a huge fan of client parties for top advertisers and special one-on-one get-togethers.

Asset Number Three: Your Brand. The identity of your station has meaning for your listeners. If it doesn't, you'll see that reflected in your ratings and research. Devise ways to highlight key attributes.

Asset Number Four: Infrastructure and Engineering. No one appreciates an engineer more than the person who calls them when disaster strikes. That backup tower or transmitter seems miraculous when you're suddenly back on-air. In all candor, the engineering staff is typically the most educated/trained member of any radio staff and yet rarely get the deserved props. We all have stories about demeaning comments made or ridiculous expectations regarding salary or hours. Now more than ever, it's past time for market managers to treat engineers with respect and acknowledge that they are a vital part of a station's success.

> **"Often new PDs will judge a morning show as literally over-rated, not realizing the importance of longevity in the marketplace."**

Don't get stuck in a manic clown car! Identify your assets and give them the understanding and attention they need to succeed. RW

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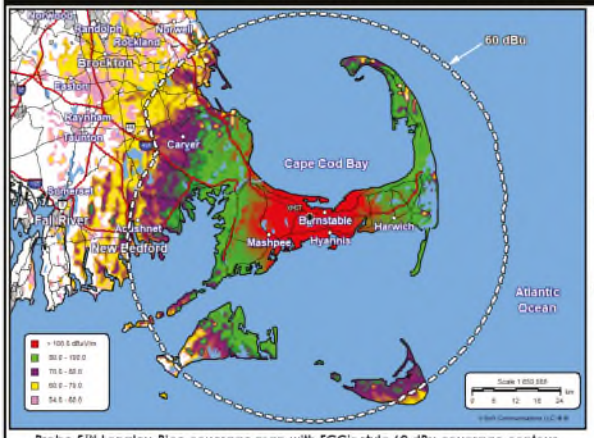

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Writer
Frank McCoy
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Salem Media Chicago

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Solutions for the CE recruitment problem

Local markets need local technical skills to address IP issues as they arise

Consolidated broadcast ownership groups face a concerning trend in recent years: Engineers are retiring or leaving the industry. There are very few or no trainees in the pipeline to replace them.

Outsourcing the work comes with risks for ownership including unstable expenses, lack of direct accountability and little loyalty. Outsourcing also draws from the same pool of older talent that continues to shrink.

I hope to offer some ideas for how to address this issue before it reaches crisis proportions. As recently as a few months ago, Salem (where I work) had six market engineer positions seeking candidates. So the discussion seems timely.

Threat vectors

I'll begin with a prediction: The days of tall tower radio are probably numbered.

For AMs the complexity of the antenna systems and often remoteness of the tower locations works against manageability. Sites that aren't remote to the market are often attractive for the land value. Stations are displaced and possibly diplexed.

Audience preference is also an issue. Electrical noise was poorly controlled by regulatory agencies early in the United States and is now basically out of control.

FMs have a different threat profile. Most occupy towers that also house television antennas. Broadcast television is happily selling off spectrum and what remains

competes with internet streaming video for audience. Cable has always been the delivery vehicle for viewers with purchasing power. The transmitter coverage mostly marks territory exclusivity and compels cable systems to pay carriage fees. Eventually the cost of maintaining transmission equipment in high places will exceed the revenue from the additional audience it delivers for broadcast TV despite the increase in "cable cutters."

Why TV matters is because the homes for FM antennas will become more scarce. The likely answer will be a digital product with areacast/geocast characteristics in the existing FM spectrum, building on present-day HD technology. These will look more like cellular, albeit wider coverage. Large and medium markets would be divided in fourths or fifths.

My estimate of the horizon for all of this is about a decade. But right now these licensed facilities, despite their likely imminent demise, are essential for the revenue model of AM and FM radio broadcasting.

Enough gloom and doom. The death of radio has been predicted many times and we remain robust. This is one of those times, and I hope these suggestions will facilitate the transition away from the present content delivery model to one that will better serve our industry in the future.

How to submit

Radio World welcomes comment on all relevant topics. Email *radioworld@futurenet.com* with "Letter to the Editor" in the subject field.

> **Résumés without meaningful IT certification credentials will go to the bottom of the pile for engineer consideration.**

The IT mindset

First, at the studio the analog architecture that borrowed from 1920s telephone technology is dead or dying. Audio over IP is now the de facto standard for radio content creation.

These systems use generic IP routers and switches from names like Cisco and Juniper along with cabling and connectors as found in every business that uses computers, which is to say every business. Only the endpoint devices — the consoles, content storage, control systems and external connectivity — are different. Even those look very much the same to the users of the former analog studio stuff, albeit with greater flexibility and user adaptability.

For these environments, technical staffing can come from a ready-made pipeline of trainees. Computer network training and certification are the answers.

Vendors like Cisco maintain educational opportunities and associated testing so that candidates come with credentials that non-technical HR personnel can rely on. And like such hires at other IT intensive enterprises, they learn on the fly about the industry-specific aspects of radio.

New IT hires at a hospital likely do not know the ins and outs of the hardware and software in use by doctors and nurses. They learn through exposure at the front lines. Bonus: Local hires with network skills can offset the cost of a "corporate" IT department with better results.

Smart consolidated broadcast ownership groups will figure this out. Résumés without meaningful IT certification credentials will go to the bottom of the pile for engineer consideration.

Clever operators and groups will see the benefit of cross-training the key operations personnel in basic IT. Again this training is available off the shelf, provided by community colleges and private concerns. Rigorous examinations confirm that the knowledge on offer is actually absorbed.

Cross-pollination between the radio lifers without a formal IT background and the generically trained IT techs that radio will recruit is essential for two reasons. Being on the front lines of radio operations will give the non-radio IT recruit an understanding of the often-chaotic business model we all know well. And presence in the market makes the IT architecture less abstract, time imperatives more compelling. Most studio plants are bespoke, with differing mixes of broadcast licenses, formats, studio and physical architecture. Expecting a tech a thousand miles away to quickly grasp the interconnection and equipment interaction is just unrealistic.

Interaction with users on a face-to-face basis rather than via an anonymous trouble ticketing system is simply better, too. When the user can stand nearby and answer questions about symptomology, and when the tech can see and place hands on the involved hardware, results come faster. Problems that are chronic are identified and fixed. Priority is driven by actual need. In environments where an existing operations staffer is up-skilled with formal IT training and certification, outsource IT hours should fall.

Summary: Local markets must have local technical skills, whether new or existing hires, able to address the internet protocol and networking issues as they arise. Centralized support simply cannot provide this. Efforts to bring order to this process simply increase local market unit frustration.

In my opinion, the studio environment is the easy part of the hiring problem. It's the transmitter sites and getting the content to the point of transmission/distribution — read "STL" — that presents the thorniest dilemma. I'll turn to that discussion next time.

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