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The Ecosystem of Streaming

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The ecosystem of streaming

Streaming of AM/FM radio is a fast-growing segment of digital audio



Paul McLane
Editor in Chief

Streaming continues to account for a growing share of time spent with AM/FM radio. As you'll read in these pages, Edison Research

estimates that among listeners in the 25–54 demographic, fully 20% of AM/FM radio time now is spent with the digital streams of broadcast stations. Meanwhile, AM/FM radio's 25–54 streaming audiences are substantially larger than those of ad-supported Spotify and Pandora combined.

Radio has a good story to tell with audio streaming, so we've returned to the topic in this ebook. We set out to learn about the latest trends in the ecosystem. We asked experts at companies like Triton Digital, Nielsen Audio, Cox Media Group, Cumulus, SOS Radio Network, Crista Ministries and Payne Media Group as well as our sponsors Inovonics, Modulation Index, RCS, Telos Alliance and Wheatstone.

We asked how the role of audio streaming continues to evolve for radio companies. We asked about best practices and new technologies that are available to help radio companies create, process, send and monitor their streams and online offerings.

As always I welcome your feedback about our ebooks. Email me at radioworld@futurenet.com.



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The big kahuna in ad-supported streaming is radio

Its audience is 44% bigger than Pandora's and Spotify's combined



Pierre Bouvard is [chief insights officer at Cumulus Media and Westwood One](#). His job is to develop media and marketing insights to support the company's media sellers and work with brands and agencies on their ad strategies.

He began our interview exploring data about radio streaming from the Edison Research ["Share of Ear" project](#). Each quarter, Edison surveys 1,000 Americans 13+ on their consumption of audio. Respondents keep a 24-hour diary to record audio use. Each published study reflects 4,000 respondents, representing a one-year rolling average.

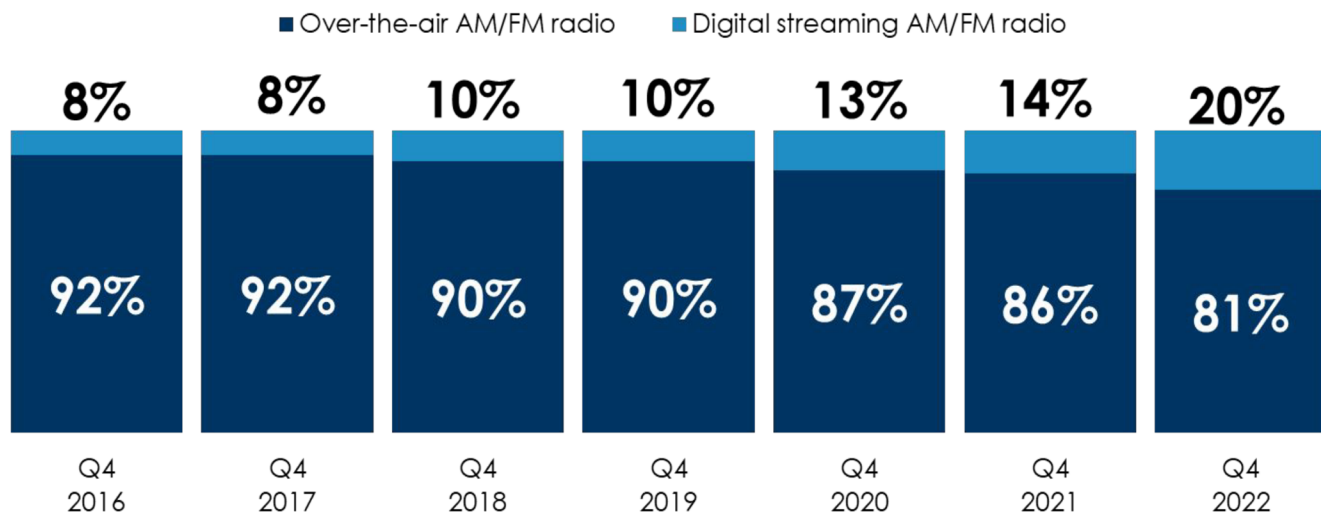


What are the Edison numbers telling us?

Pierre Bouvard: This first slide shows the percentage of AM/FM radio listening, how it's split

Streaming surges as a percentage of total AM/FM radio listening; 20% of 25-54 listening occurs via streaming

Share of audio time spent between over-the-air AM/FM radio listening and digital streaming
AM/FM radio listening, persons 25-54



Source: Edison Research, "Share of Ear," Q4 2017-Q4 2022; Persons 25-54.

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“For American adults 25 to 54, 20% of all minutes spent with AM/FM radio now is occurring through the stream. That’s double from the end of the last decade.”

between terrestrial over-the-air in dark blue and streaming in light blue.

Something altogether different started happening last year: We saw legitimate increases in minutes spent with the AM/FM stream. For American adults 25 to 54, 20% of all minutes spent with AM/FM radio now is occurring through the stream. That’s double from the end of the last decade. That’s pretty substantial.

For years, streaming was just a very small percentage of radio listening. Now it is definitely growing. It’s surprising to agencies to learn that the AM/FM streaming audience is 44% bigger than Pandora’s and Spotify’s ad-supported audiences combined. If you’re enamored with streaming as an advertiser and the first words out of your mouth are Pandora and Spotify, you’re forgetting that the big kahuna in streaming is AM/FM radio.

But as the next slide shows, it is a tale of two cities, or rather a difference between men and women.

For men it’s stunning — 28% of 25–54 male listening is streaming, while for women (not shown) the percentages really have not changed in the last five or six years, hovering at 10% of listening.

Let’s dig further. On the right side of the slide on page 5 is the type of content that men are listening to.

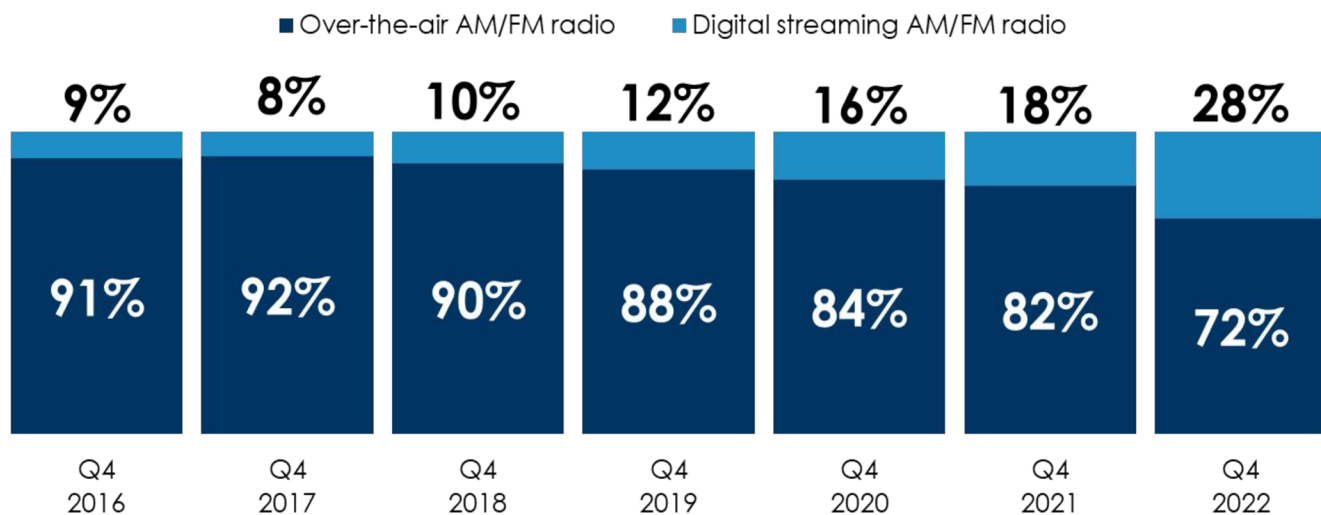
Two things pop out here. One is Talk/Personality — it’s much higher than with women — and then look at sports for men, compared to women and their zero-point-two percent.

So spoken word content is what’s driving growth in listening to radio streams for men. And in both streaming and over-the-air AM/FM radio, men spend more time with spoken word content than women.

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Men 25-54: Streaming leaps as a percentage of total AM/FM radio listening: 28% of listening occurs via streaming (3X women 25-54)

Share of audio time spent between over-the-air AM/FM radio listening and digital streaming
AM/FM radio listening, men 25-54



Source: Edison Research, "Share of Ear," Q4 2017–Q4 2022; Men 25-54.

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Of time spent with AM/FM radio, women consume more music than men; Sports garners a high share of male AM/FM radio streaming

Share of AM/FM over-the-air radio time spent by genre

	Over-the-air AM/FM radio		
	Persons 25-54	Men 25-54	Women 25-54
Music	74%	62%	83%
News	16%	22%	10%
Talk/ Personality	7%	9%	6%
Sports	4%	7%	2%

Share of AM/FM streaming radio time spent by genre

	Streaming AM/FM radio		
	Persons 25-54	Men 25-54	Women 25-54
Music	56%	49%	74%
News	22%	23%	20%
Talk/ Personality	11%	13%	7%
Sports	12%	16%	0.2%

How to read: Of the time women 25-54 spend with AM/FM radio streaming, 74% of it is spent with music.

Source: Edison Research, "Share of Ear," Q1-Q4 2022; Percentages may not add up to 100 due to rounding.

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We've learned also that smart speaker listening is important. In their "Infinite Dial" study every other year, Edison asks the question, "Do you have a radio in your house?" The number has been dropping and dropping. But look at the slide on page 8, which shows ad-supported radio.

The point is that if you're in a house that doesn't have radio, the smart speaker is your best friend. Since 2017 radio has done an amazing job of promoting how to listen on a smart speaker. So hats off to us as an industry. But we've got to keep doing it, because there are still a lot of listeners who would be astonished if you said to them, "Do you know that you have a smart speaker and you could listen to radio stations on it?"

What conclusion should a manager take from these data points?

Bouvard: You have to treat streaming like a real radio station.

Consider the list of questions that you ask yourself about your over-the-air broadcast: Does it sound clear? Are the commercials well inserted? Are the commercials well separated, meaning you're not going to hear a GEICO spot every break? Is the sound at a consistent level? When you're inserting extra songs, how is that transition?

Back when streaming was 8% of listening, some stations may not have gone through that quality checklist. Now you have to treat streaming as seriously as if it was another FM stick — especially if you're a station targeting males and a third of your listening is to the stream.

What do you think about the quality of streaming that you hear across the industry?

Bouvard: Here's something interesting. Historically, when the numbers were small, the feeling in the industry was to report the station separately — so in a PPM market, you'd put an encoder on the stream, put an encoder on the over-the-air signal and report them separately because maybe you could make a little bit more money with different advertisers on the stream.

But in 2020, Nielsen implemented a methodology enhancement called the headphone adjustment. It recognized that there is a fair amount of stream listening that occurs via earbuds or earphones and is not captured by the PPM. It quantified this by demographic, by format, and how much listening wasn't being captured; and they instituted upward adjustments to streaming listening.

On average, the typical streaming audience grew 60% when this was implemented. Programmers and sales



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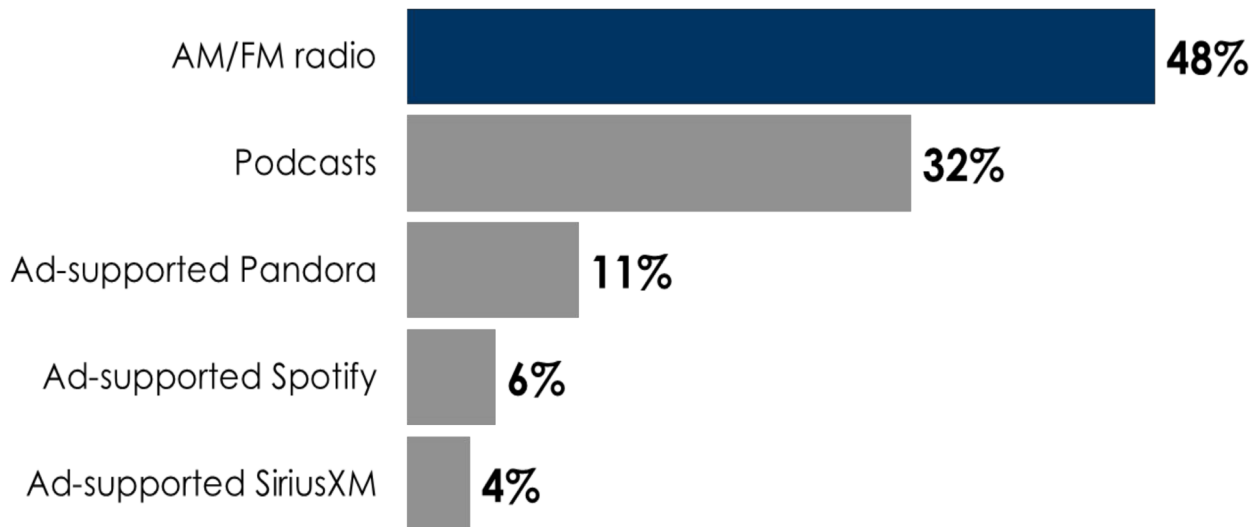
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Smart speaker listening: AM/FM radio has the largest ad-supported audio share

Share of ad-supported audio time spent on the smart speaker, among persons 18+



Source: Edison Research, "Share of Ear," Q1-Q4 2022. Persons 18+; SiriusXM: Ad-Supported: Spoken Word. Ad-Free: Music.

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managers suddenly were looking at their streaming numbers and PPM and seeing them growing sizably. Some sports stations learned that a third, 40%, 50% of their audience listened on the stream. Especially for spoken word stations, the numbers were no longer trivial.

That introduced a new mindset: "We used to report these things separately but what if we bring them back together?" There has been a movement over the last couple of years to what's called total line reporting, a simulcast, so stations can get a nice big number in the Nielsen.

This is a long way of answering your question, but when with a literal simulcast you don't have uncomfortable segues or different ads or songs being inserted. In some respects, the unification of the stream and the terrestrial has increased quality because programmers are programming one station that just happens to be distributed across two platforms.



What other factors are at play in the digital audio marketplace?

Bouvard: There's a general sense that digital audio — podcasting and streaming — is really growing, especially with national marketers. Podcasting is on fire; about half of that is from direct response advertisers who will tell you they've never seen anything like podcasting to

sell products and services. The other half are regular national advertisers.

The CPMs in podcasting are four times the CPMs of regular radio. Four! Why? Because it works so well. And it's a low-commercial environment where, in the typical hour, you might only have four or five minutes of ads.

The "Share of Ear" reports show that the growth of streaming came at the expense of owned music, not really radio. What's causing the erosion of share for terrestrial radio now, I believe, is podcasting. The shares from Pandora and Spotify over the last six years are basically flat to down while the shares for podcasts have gone like this *[gestures sharply upwards]*. If we're losing audience, it's not to the streamers, it's to podcasting.

Podcasting for the most part is a national medium right now, like network TV, but that's changing. For some people who want to listen to a particular radio show, podcasting is a godsend because it allows time shifting; and for local radio, that's a growth opportunity.

If you want a glimpse into the future, look no further than Southern Cross Austereo in Australia, which has national shows in the biggest markets. Their talent first record the podcast, then they take segments of it to use on the over-the-air radio show. They release the podcast first rather than the other way around because those listeners are super-engaged.

A look at Nielsen's approach to radio streaming

Jon Miller talks about PPM, “earbud uplift” and Market-Wide TLR



Left
Jon Miller

"As of the start of this year, time spent with the digital streams of broadcast radio stations nationwide hit 20% of the total time spent with all radio among persons 25–54," says Jon Miller, vice president of audience

insights at [Nielsen](#).

"That's not an insignificant number and reflects the evolution of audio use over the past decade as digital streaming became so widespread."

As noted in the earlier interview with Pierre Bouvard, that data point comes from Edison's "Share of Ear" study,

which has been tracking the percentages for many years. For comparison, at the beginning of 2021 the number was 14% of all time spent with radio was coming from digital streams. Today it has grown to 20% in this demographic.

We asked Miller for insights into Nielsen's approach to streaming in the radio ecosystem.



Briefly describe how Nielsen captures and quantifies radio audio stream listening.

Jon Miller: In PPM markets — the top 50 largest markets in the U.S. — we use encoding technology to passively capture what panelists are exposed to. Encoding is simply

“With this new service, they will now have access to a comprehensive view of broadcast streaming for any other station in the market that is in a TLR relationship.”

an audible (but undetectable to the human ear) watermark on any piece of audible content. So in those markets, broadcasters can encode their digital streams and the PPM can pick it up. Across the rest of the country, in 200+ diary markets, we ask diary keepers to note how they are listening to the station, and if they note that they are listening to a digital stream of a station, that gets counted in the ratings, as well.

RW **How does Nielsen account for the fact that some stream listening is done on earbuds, where the audio presumably is not detectable by the PPM system?**

Miller: Starting in late 2020 we introduced the headphone adjustment, which accounts for this gap in measurement. The headphone adjustment is a statistical model developed by Nielsen and based on extensive followup research with former PPM panelists, about how often they use earbuds or headphones to listen to streams of broadcast stations. In essence, the adjustment boosts the AQH for all digital streams of broadcast stations. It was updated in 2021 and we are planning to update it again later this year or early next year.

RW **Following on that, how much of an uplift was provided after Nielsen implemented the new factor to account for earbud listening?**

Miller: The uplift to overall radio AQH in the PPM markets was 4% when we first introduced the headphone adjustment in October 2020.

RW **Do current diaries ask survey participants whether they were listening to a stream? If not why not?**

Miller: We instruct diary keepers to note as many details as possible about the stations they are listening to, including if it is a digital stream.

RW **What steps should a Nielsen client take to assure that they're getting the most accurate, highest-quality measurement data about their streaming?**

Miller: In PPM markets the streams need to be encoded in

order to be measured. Stations can work with Nielsen to get the technology in place if it isn't already.

RW **What is Market-Wide Total Line Reporting and why does it matter?**

Miller: This is a new service that enables clients in only PPM markets to see a market-wide view of streaming audio consumption. Previously, clients could only see these estimates for their own TLR stations, limiting their ability to fully understand market trends and shifting consumer habits. With this new service, they will now have access to a comprehensive view of broadcast streaming for any other station in the market that is in a TLR relationship.

RW **Nielsen reportedly is working toward electronic rather than paper diaries in the future. What are the implications of measuring streaming listening, if any?**

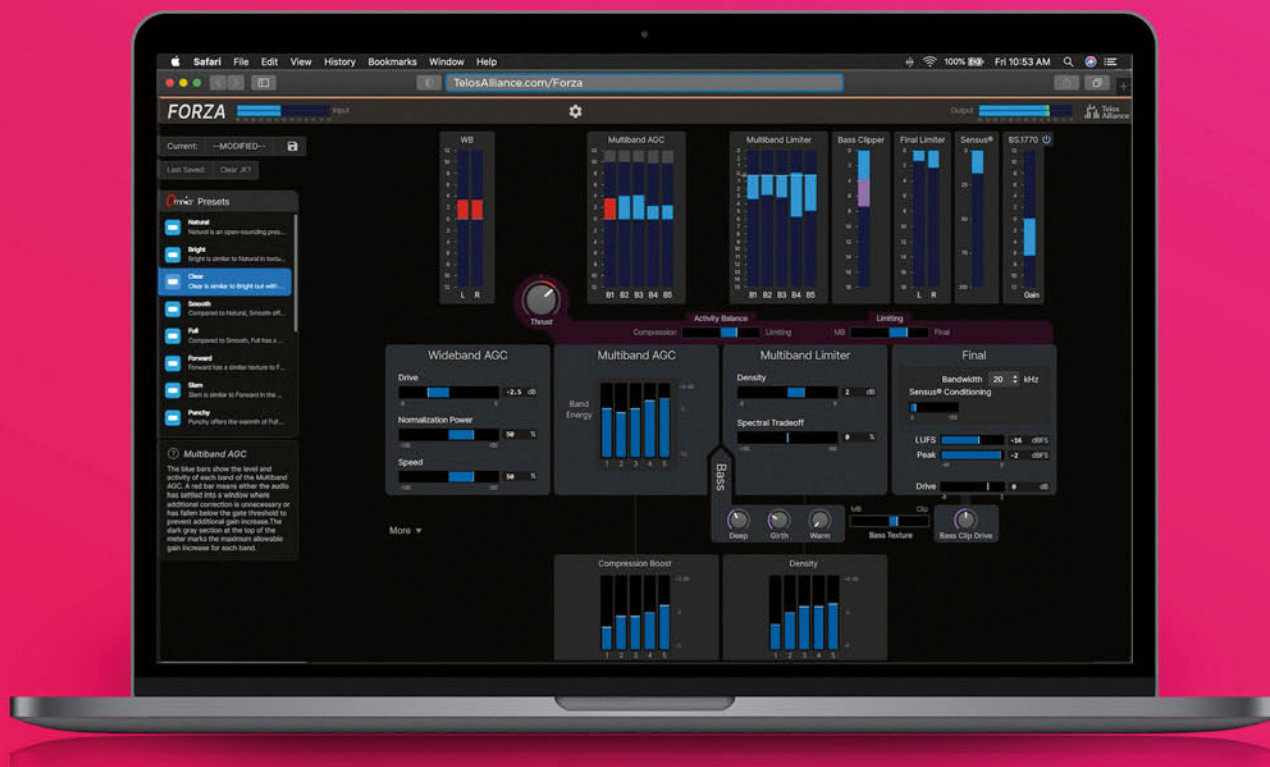
Miller: Conceptually the mobile survey (which would move from the current paper diary to an online diary) will act very much like the current system, only it will be a digital service rather than something you fill out by hand. Diary keepers will continue to be asked to note as many details about the stations they are listening to.

RW **How close are we to the radio industry having a holistic measurement that combines server-side streaming and terrestrial measurement? What's your message to radio clients about them providing their data to Nielsen to support that?**

Miller: This is a top priority for Nielsen as we look to continue evolving our measurement of the audio landscape. In order to capture and account for all the ways consumers use audio, we are working to develop solutions for both content and ad measurement. The framework for this combines census-level proportional measurement — what we do now with PPM panels and diary samples — with rich big data sets such as the server-side streaming data you referenced. We will continue engaging with radio clients on this front and will work at the pace the industry is ready to move at. **RW**

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In small markets too, streaming matters

Payne Media Group complements and expands its footprint online

Writer

Paul
McLane

Streaming is an important part of the media package for [Payne Media Group](#) and third-generation broadcaster Will Payne.

His family began in the business with an AM station in Cushing, Oklahoma, in the 1950s. The company now owns almost two dozen signals in eastern Oklahoma and northeast Texas (12 FMs, one AM and nine FM translators). It began streaming in the late 1990s.

"You get the same content on our streams that you hear on-air for the majority of our stations, but we also stream events that may not be available on the air," he said.

"In an urban metro area, our streams and the terrestrial FM, AM and HD content are complementary, though in rural Oklahoma we're still struggling with broadband issues, so streaming numbers are just not there for the rural broadcaster. While good connectivity might be considered 25 Mbps up and 25 down, in our market you may see 5 Megs down and 1.2 Megs up. But we're not going to have bad internet forever."

Payne Media Group provides feeds in MP3 and AAC. Will Payne says the devices used most to listen are smartphones rather than smart speakers. "The tablet and cellphone now have replaced the home radio or the work radio."

While his stations can be heard on TuneIn, most people access the streams via a consolidated Payne site. "We developed a separate website called [Paynecast.com](#) where you can go for all of our live streaming, on-demand, podcasting and video. We used to promote each radio station's site; now we've aggregated it all."

Payne's stations use [RCS](#) automation and feed the output to [Omnia.9](#) processing, which supports streaming and feeds the content distribution network. "It's the same audio that you're getting over our HD and FM transmitter, so it's



pretty darn good. That was one of the benefits of going to an all-in-one box; you are getting really good audio, and it's digital."

Payne offers ad insertion when appropriate, but "we find that a pre-roll advertisement is the most popular with clients." He likes that management knows how many people are listening based on data from the streaming provider. "For us it's live local programming. High school sports is our highest-ranked event for live streaming, then our streaming numbers throughout the day are pretty consistent."

Any tips for a first-time local streamer?

"If you're doing any kind of high school sports or talk

Right
Will Payne

The Ecosystem of Streaming

A screenshot of the Payne Media Group website. At the top is a large banner with the Payne Media Group logo (a stylized 'P' in a circle) and the text 'payne media group'. Below the banner is a row of logos for various radio stations: HD94.7, 96.5, KDOE 102.3, K95.5, OKIE COUNTRY 101.7 KTFX, 99.5, Country Legends 105.9, ESPN PARIS, TX (105.1 FM), BILLY COUNTRY 98.5, and LAKES COUNTRY 102.1. The main content area features a sidebar on the left with links: ABOUT US, RADIO, WEBSITES, EMPLOYMENT, CONTACT, IN THE NEWS, LOGOS, and PHOTOS and Audio. The main text area has the heading 'How to buy radio and digital advertising' and a subheading 'We deliver smart local radio, compelling content, engaged audiences and successful clients.' Below this is a quote: 'Like any advertising medium, there's a "right" way to do radio and a "wrong" way. The right way is to craft commercials that motivate listeners to take action.' The Payne Media Group logo is prominently displayed. To the right of the main text is a vertical list of radio station logos with play buttons: K95.5, KDOE 102.3, 96.5 sports rock, OKIE COUNTRY 101.7 KTFX, LAKES COUNTRY 102.1, and BILLY COUNTRY 98.5. A map of the Dallas area is also visible. At the bottom, there is a section titled 'Ahead of 2022-2023 Season – Cowboys pick up Payne Media Group' with a paragraph of text about the Dallas Cowboys Radio Broadcast.

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content, you've got to stream that first. People crave their local news, weather and sports. But if you decide to stream, roll it out. It's easy now. Just make sure you've got a good backbone for internet to get good audio to those servers."

Streaming and other media represent growth areas, but passion for local radio comes through in Payne's voice.


"I have a huge affinity for AM, FM and HD Radio. My family has been in the radio business since 1951. I'm not going to be the last one. I started in broadcast with my dad when I was eight years old, and I've been on the air ever since," he said.

“High school sports is our highest-ranked event for live streaming.”

"So we're doing fine and that's where my heart is. But I also want to look forward to what my kids are excited about; and they're excited about audio on the phone, about watching play-by-play; so we're into live video, we're into live podcasting. And we have fabulous studios in multiple markets; we can bring individuals in who lease our studio to do their podcasts. If they need an engineer we'll provide one, we make that a part of our service.

"We have the tools, we have the expertise and we have excellent people who can get all of that done for our customers. So the technology is a little bit different, the platforms are a little bit different, but we're still serving our local communities."

Unprompted, Payne adds a postscript of appreciation for today's technical solutions.

"The equipment that's available today is better than anything we've ever had in history. We've got solid-state transmitters. We've got audio over IP consoles. I mean it's not necessarily inexpensive, but at least I'm not replacing tubes anymore. There are so many things that I can do with this technology, and it's going to last me another five, 10, 15 years. The cost of doing business is really coming down with the technology." 

Above
The Payne Media Group home page.

Crista uses streams to help spread the Word

Careful monitoring and good analytics are important tools for this Christian ministry

Crista Ministries is a family of five ministries based on a campus in Shoreline, Wash., just north of Seattle. Its Crista Media arm broadcasts Christian music to northwest Washington on KCMS(FM) in the Seattle area and KWPZ(FM) in Bellingham, as well as religious teaching on KCIS(AM) in Seattle.

Each station has a simulcast stream; Crista also offers online streams called Quiet Time Radio and Lift Radio, the latter of which is also heard on the HD-2 channel of the Seattle FM. And there is a podcast network and a lifestyle blog.

Chief Engineer Aaron Hume said the organization jumped into streaming “as soon as RealPlayer came out with streaming over dialup.”



Can you describe your streaming “air chain”?

Aaron Hume: For most of our streams we go out of RCS Zetta, through our consoles and EAS boxes, then to our silent sense boxes, and then right into the encoder or off to the air chain.



What streaming encoders do you use?

Hume: I've been here 11 years now, and one of my first big projects was the streaming coders, which was a good learning ground. I built them in 2012.

We've been using Orban Optimod-PC 1101 cards and they

are awesome. However we plan to migrate to [Wheatstone StreamBlades](#). With Windows 10 and all the updates that continue to break things for radio, the PC is not a direction that I want to pursue; if we have an appliance such as the StreamBlade I would feel a lot more confident in it. And we'll be saving about 20 rack units of space.

From there, we send it out to StreamGuys, our CDN. We have two server operations that we connect to in different parts of the country, so if some of the backbone goes down through our main infrastructure, we should be able to still hit the secondary server in a different part of the country.

On top of that, we have two internet providers at our broadcast facilities, so if Comcast goes down, we still have Zipyly or vice versa.

It's important to make sure our stations are easy to find on smart speakers. When Amazon Echo came out, it worked great because we were already set up with TuneIn as a registered service. When iHeart took over the search portion of that with the default “hey, I want to listen to a radio station” sort of vibe, everything broke, so we ended up putting in specific Amazon Skills through StreamGuys. Then we could say “Hey, enable the Skill on your speaker,” and it would go by our prompts at “Play Spirit 105.3,” whereas before it would come up with some really weird station that was not in line with our organization or our content.

Since then Amazon has taken the reins back and said, “We want to help radio stations, let us get you listed properly so it's easy for people to find you.” We still have our Skills with StreamGuys, but we also have a direct connection with Amazon that should have been there from the beginning.

Google Home has options to set up radio stations with their equivalent of a Skill.



Do you have a sense of what percentage of the audience uses various platforms to listen?

Hume: One of the things that we are able to do with StreamGuys is split out aliases, so to speak. You can take one stream and say “This is my Icecast main stream,” then they can replicate it and call it the Amazon stream or another stream. We can give that URL to Amazon or whomever, and dedicate it for analytics collection, even though we're only sending one stream out.

That has been useful to me as I go through monthly stats for our staff and salespeople to give them human numbers



Right
Aaron Hume

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- Stream formats: Icecast/Shoutcast, HLS (Raw, MPEG-TS, fMP4).
- Stream Rotation – the 611 will rotate through preset streams sequentially monitoring one stream at a time.
- Failover Support: Preset back-up streams with customizable failover triggers.
- Easy front-panel setup uses jog-wheel menu navigation and the front-panel readout. The corresponding Web interface offers a detailed presentation and additional options.
- Adjustable output levels for Analog L/R and AES-digital
- Alarms & notifications via email or SMS for audio loss, stream loss, internet loss, and high ping time.



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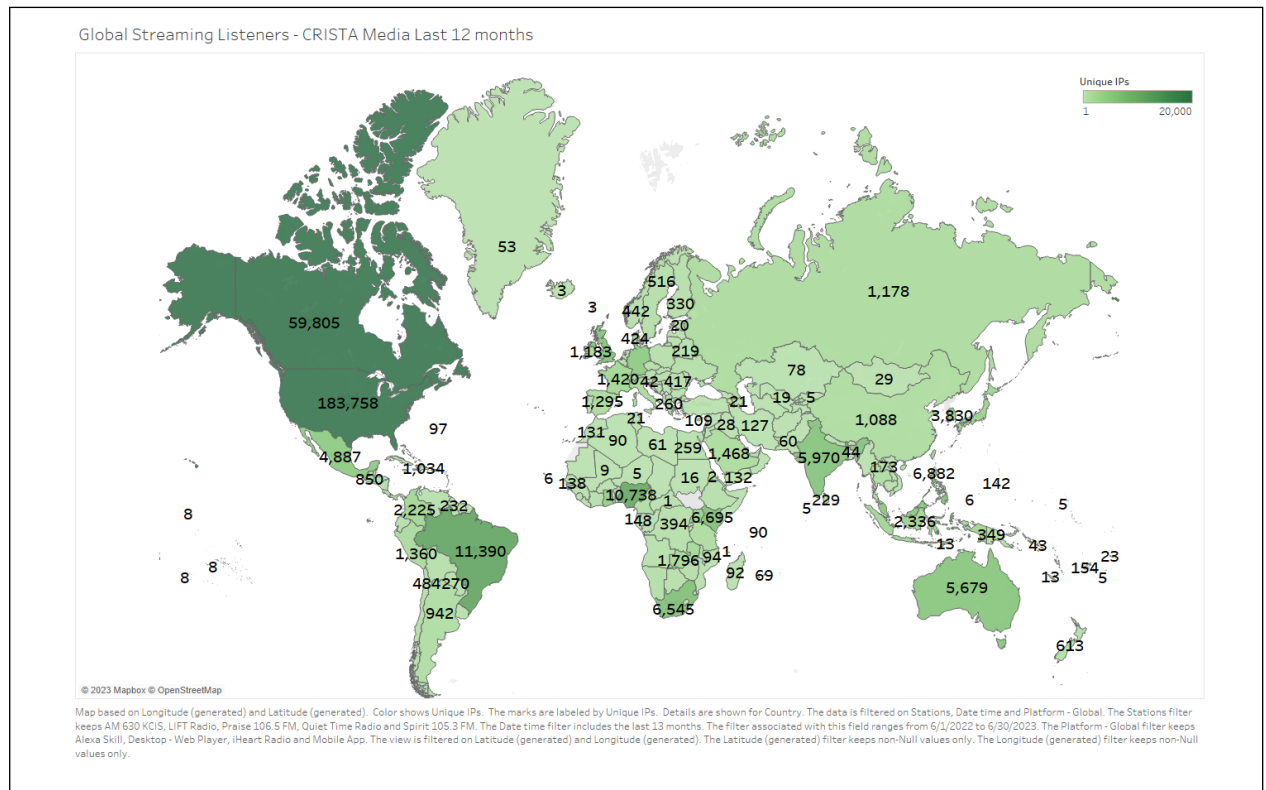
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The Ecosystem of Streaming

Right
Hume creates useful summaries for management, including country by country listening, using data from StreamGuys that he imports into Tableau data visualization software.



that Nielsen can't — unique IP addresses, that sort of thing.

I'd guess a third to half of our listeners now use smart speakers — it's way up there. A lot also use our mobile app, and a good chunk use the iHeart platform, which we're listed on. We try to be everywhere, as much as possible.

SoCast produced a dedicated app for us. It's a way to give listeners a lot more information. We've got contests and information on there, and events.

The next big thing is going to be platforms such as the DTS AutoStage, with hybrid radio switching the over-the-air reception to streaming, for people driving out of market. It will be a small percentage of drivers at first but I can see that sticking because automakers want "new and fancy."

RW Does it matter which browser someone is using?

Hume: We've been good about testing browsers with our web players. In the past this was a bit problematic because of things like autoplay functionality. Browsers change all the time, so you have to keep an eye on them and work with your web player provider to make sure there aren't any weird bugs.

We were primarily using a Flash player until five or six years ago, when we switched to an HTML5 player. Of course Flash is dead now so I'm glad that we didn't wait.

RW We hear repeatedly that metadata management is important.

Hume: It's a really important conversation. We did beta testing of the [Inovonics 611 Streaming Monitor](#) last year and decided to purchase one because it has been

valuable for keeping an eye on our streams.

We sell metadata to our clients; we can synchronize their ads on the air with texts that you see on the screen, but it has been challenging to keep an eye on everything. We needed to develop a metadata stream specific to StreamGuys so our internet side would be exactly what we want it to be all the time.

I set up the Inovonics receiver to send me notifications when it couldn't detect any changes in metadata for a chosen time interval. I set it for an hour. In fact it just popped up this week saying, "Hey, your metadata hasn't changed." The problem usually is just a data disconnect, and we just have to restart a service. But it didn't have to go like that for a couple of days before somebody complained about it.

It's really important to keep an eye on this if you're going to be monetizing it.

RW Any other advice for others?

Hume: Make sure you've got everything buttoned up with SoundExchange for licensing and royalty payments. Then pick a good preferred encoder type and go with it.

Also, analytics are very important at our organization. I can give my management real data on listenership. I can tell them how long people have been listening, and approximately where they're listening from. I get in-depth logs from StreamGuys and I bring those into Tableau and make it pretty for our people to look at. **RW**

“You have to treat streaming’s importance as if it’s your OTA transmitter”

Morgan Grammer of Cox implements an integrated solution

As director of engineering for [Cox Media Group's](#) operation in Tulsa, Okla., Morgan Grammer oversees technical operations of five radio stations including a news/talk on a 50 kW AM and associated FM signal. He also plays an important role in the wider company's streaming deployments. Grammer has been interested in streaming since the days of RealNetworks and says he recently discovered his RealAudio CDs in storage.



How does Cox manage its radio streams?

Morgan Grammer: There's a digital team that oversees applications, websites, encoding. In each of the markets the DOE is tasked with making sure the streams are online, metadata is arriving and so on. We've got tools we use internally to make sure that what listeners hear and see is correct. Obviously our digital sales team is involved, and our ad serving partners are doing spot insertion.

Every station has an MP3 stream and an AAC stream, and we have redundant CDNs.

You have to treat streaming as if it's a transmitter. I remember the days when you could plug a Sound Blaster card into the back of the Optimod. Now we treat all our streams as if they were full-power stations, because we never know where somebody's streaming. Are they listening on an Alexa device? Are they listening with an Xperi digital dashboard? [RadioDNS](#) plays into this too; somebody could be listening on your stream because they've driven outside of your coverage area and want to hear the end of an interview on KRMG or WSB.



You have a big streaming project at Cox right now.

Grammer: We had a legacy streaming product running on a lot of aged computers and knew we'd have to spend some money if we wanted to keep it current. One of the things I've been responsible for in choosing a platform is making sure everything is correct and consistent across the multiple data streams we send.

Wheatstone has a new product called the [StreamBlade](#), which we've decided to deploy across our markets for streaming. I oversee the migration of the encoding and have been doing a lot of the R&D work with Wheatstone.



Left
Morgan Grammer

It used to be that you had an audio processor of some kind — whether it was a dbx or a big fat on-air processor — and you also had encoding and the metadata. WheatStream brought all of that into one appliance that easily integrates with our Wheatstone on-air consoles and systems.

One benefit of the appliance is the ability to spin up encoders quickly. Our legacy arrangement had one station per computer.

The WheatStream product can handle up to eight stations in one appliance, so we went ahead and licensed an extra encoder per market. If there is breaking news or we need to split an AM/FM combo quickly, we've got an encoder ready to go. Each of our radio stations has four separate streaming destinations delivered to two CDN datacenters and we're sending them both MP3 and AAC versions of each radio station.

We looked at some virtual stack solutions too. Everybody's talking about how you could virtualize everything, you could put it in the cloud. I think we'll eventually go that way. Right now there isn't the cost/benefit ratio we want. Still, we're pushing a lot of workflows up to the cloud, trying to make the most of collaboration across markets, and I'm watching with bated breath to see what the vendors are doing and who's going to be the leader to make all this stuff work together.

The Ecosystem of Streaming



What common issues should engineers be aware of?

Grammer: Metadata is number one in my book. There are so many audio choices at this point that you've got to keep your listeners engaged.

Are you giving me album name, title and artist, or just your station slogan? Do you have an integrated app that shows album art? Is the title accurate, are spelling and punctuation correct? I know that seems silly, but in some cases I've seen ... wow. Are your spot insertion triggers on-time?

And does your stream sound good? Is it clean? Processing it with an old FM over-the-air processor doesn't cut it. We don't clip audio. People are listening with headphones and ear pods, they're constantly on the go, they do not need audio fatigue.

So process for time spent listening, not loudness-war maximum impact.

And don't kill their ears the minute that screaming car commercial comes on. If you're doing local spot insertion, process your spots so that everything has a consistent sound.

If you're working with an ad partner, find out how they're processing and make your levels match theirs so there's a consistent experience. If you can't get their buy-in, maybe it's time you find another ad partner.



What would you say is the most important recent evolution in how streaming is done?

Grammer: Managers of facilities like ours that have five or six radio stations need to send all that audio somewhere. Are you going to encode that audio locally? Do you do all the compression at the studio and then split it somewhere else? Are you uploading linear audio from the studio? How are you handling the bandwidth and the buffering? There are lots of solutions to connect multiple sites and route audio back and forth, but how will you do that for a stream?

A lot of manufacturers are focused on integrating processing, metadata and encoding, and plugging that into a package that can be virtualized. If you're a music station and everything is voice tracked, you can play it out of automation in the cloud, virtualize the processing, streaming and encoding. But for my news/talk that's doing multiple hours of live news in the morning and afternoon, or for a music station that's got live morning talent, how am I getting that up to the cloud? How am I grabbing segments locally?

I personally think that what makes us better broadcasters is being live, local and relevant. That was one of the reasons Cox still has our encoders in-market. We do the processing and treat everything as an in-market solution instead of a massive stack in the cloud to process and distribute everything.



What are the best transport protocols?

Grammer: We are standardizing initially on [RTMP](#) as a minimum to get above just straight HTTP streaming. A lot of legacy encoders were just pushing Port 80 HTTP, but oh my goodness, when something breaks, it breaks bad.

We are working and testing to shift to HLS, but a great end-to-end solution with spot insertion isn't quite there yet. There are several companies working on this, and I'm eager to see what they come up with. This was another requirement when choosing the WheatStream appliance since it supports all three of these protocols.

We want our connection from a local encoder to the CDN to be as robust as possible, which is one of the reasons we're using disparate CDN connections and duplicating everything between multiple data centers. If one burps, we've got a backup.

Treat your internet connection as you would your STL, meaning you should have a backup of some kind. It may not support the entire office, but even a cell phone hotspot on a secondary switch port somewhere could be a benefit when fiber backhoe fade comes along and eats your lunch.

In many of our markets we put in two streaming encoders, two StreamBlades with redundant power supplies. Again, the mantra "treat it like a transmitter." Have parts. Have a backup.



To what extent does the user's choice of browser and device matter?

Grammer: The Cox digital team has worked hard to have a player that will work across multiple browsing platforms and deliver a unified experience.

We also encourage our listeners to download the station apps for an even better streaming experience. There's also a talkback function in the app, and we can use that material on air as another route to interact with them.


We do have a significant amount of listening on IoT devices, including listening to individual snippets of our broadcasts, like news briefs for quick consumption.



Other thoughts?

Grammer: First, make it easy for your listeners to find you; don't put them through gyrations of cutting and pasting links. Get with your webmaster if you don't know how to how to implement this stuff. Find somebody who can help you come up with a good player that so people can easily get to your content.

Second, start learning virtualization technologies or systems if you have not already — VMware, Proxmox or similar. We are headed into a virtual stack at some point. Whether it's an all-glass control room, versus just streaming and processing, or microMPX sent to tower sites, a VM is going to be in your world.

And we are beyond squashed audio. Be easy on people's ears. Process your stream for building time spent listening, not FM maximum impact. 

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Monitor it if your stream matters to you

Ben Barber says “We monitor what we find important in life”



Ben Barber is president/CEO of [Inovonics Inc.](#) He recalls that one of his first jobs was soldering patch bays at the local AM radio station where he grew up.

RW What has been the most notable evolution in audio streaming for radio?

Ben Barber: Today's radio audiences are not only over the air. A big part of the audience listens online, many more than were listening a few years ago. That means the station's programming will be listened to in many different environments, not just cars, but phones and computers as well as smart speakers. With this added “outlet,” metadata needs to be closely looked at and monitored since “radio” isn't “pictureless” any longer.

RW What types of technologies have become available to help?

Barber: In the past, stations took a feed from their on-air audio processor and simply sent that to a streaming provider. That may not be the best practice any longer. Streaming algorithms don't like hard clipping of the audio, so care needs to be taken in balancing a dense sound while making it not sound overprocessed.

RW What role does monitoring play including things like audio presence, audio quality and metadata?

Barber: Monitoring it super important. If you're not monitoring your stream 24/7 it is really easy for a server to drop a connection or a third-party aggregator to drop your stream and you not be aware of it. There are software programs that can monitor your stream but a dedicated hardware box is the best option.

Inovonics just launched its [latest Streaming Monitor](#),

which can do HLS streams as well as HTTPS streams, and gives you all sorts of diagnostics. It monitors metadata, stream quality, dropped packets, ping and audio buffer quality.

I like to say that if you're not monitoring your stream, you must not think it is important. We monitor what we find important in life!

RW Why is HLS important?

Barber: The beauty of HLS is that the internet is great at “bursting” data and not so good at keeping a constant flow of data going. This burst is typically 8 seconds of audio data, so every 8 seconds you get another burst. The audio player then slowly plays this audio out, and as the buffer decreases another burst of audio is downloaded, which replenishes the buffer.

In our Model 611 Streaming Monitor this buffer is constantly monitored and displayed graphically. This assists the engineer in seeing if things are happening quickly enough. This graph can be expanded to display up to 24 hours of history, which again gives the engineer the ability to “see” that their streaming server is keeping up.

RW What is the role of variable bitrate technology?

Barber: Another feature of HLS is that if the network connection is not great, the bitrate of the audio can be lowered, preventing dropouts of the audio. It's true that the audio quality will not be as good, but it's better to have lower quality than silence!

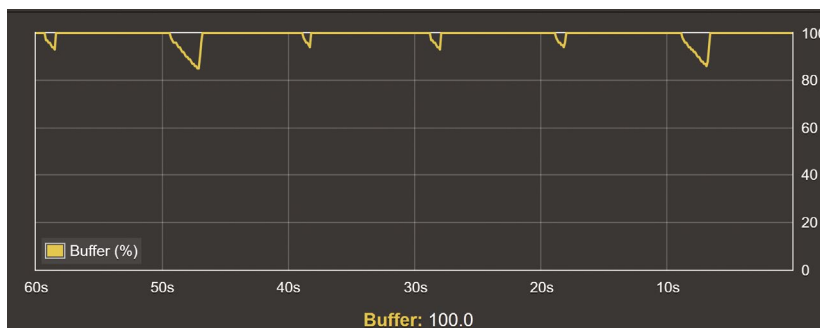
The connection between the listening device and server is constantly monitored, and when lower quality is required to keep the “audio playing,” lower-bitrate chunks are served.

RW How can monitoring help with variations in loudness from different sources?

Barber: The Model 611 has the ability to do StreamRotation, which means it can sequentially monitor multiple streams. With the graphing in the Streaming Monitor you can quickly see which streams are “louder” or “softer” than others. It doesn't mean that the loudness wars of OTA radio need to happen, but a similar loudness or levels should be maintained between streams of similar formats. If a listener changes streams, they don't want to be constantly changing the volume level. **RW**

Above right
Ben Barber

Below
A graphic display
of the buffer
described in the
text.



Triton brings programmatic buying to OTA

Brands and agencies can purchase broadcast radio ads programmatically

Triton Digital offers a suite of audio advertising technology including ad insertion to support the streaming and podcast strategies of audio publishers such as radio stations, along with content delivery (CDN) and audience measurement products. The company became part of iHeartMedia in 2021.

Jean-Luc Wasmer is VP, partnership integration & architecture.

RW Triton made a notable announcement this month.

Jean-Luc Wasmer: You probably know that we created the first digital ad exchange back in 2013; today the Triton Audio Marketplace offers access to the largest single pool of audio audiences, with more than 100 billion audio impressions per month.

Programmatic is a fast-growing part of digital, and lately there has been much interest in PG, or “programmatic

guaranteed,” where brands and agencies seek the same kind of guarantees they would typically get with directly sold ads.

Now we’ve brought programmatic to the over-the-air context. Starting with Basis Technologies, one of our demand-side partners, [we can offer PG buying access to broadcast radio ads](#). A few other Triton partners are already upgrading their integration to take advantage of this new offering.

This streamlines and consolidates advertising across all the audio segments — podcast, streaming and now terrestrial broadcast radio — via our Triton Audio Marketplace. We’ve made broadcast inventory from iHeartMedia available in that marketplace, with more broadcast partners who are represented by Katz Media to follow.

The recent merger of [Jelli into Triton](#) accelerated this project. Most stations in the United States have the Jelli platform integrated, so we are leveraging that infrastructure.

The first programmatic ads over the air were [heard on KLAC](#) in Los Angeles in March. We’re very excited about it.

With this technology you can buy digital but also buy over-the-air within the same tool. Slowly, radio buyers who have been in the industry for many years are going to retire, and the new generation of buyers only know digital. They don’t know how to access over-the-air options. Our goal is to tell them, “We’re going to make that inventory available to you using the type of buying tools that you use to buy digital.” We continue to remove the barriers to cross-platform audio advertising.

It solves another problem for them too, because digital audio doesn’t have the scale of radio, and sometimes they have a hard time reaching the goals of their campaigns.

Our next step will be to bring that option to open auction and private-marketplace deals. The challenge is to be able to figure out all the industries that have ads in a given broadcast break and to be able to choose the proper advertiser without clashing. It’s tricky because typically playout systems are not aware of these distinctions, so we need to work with the broadcasters to be able to access that information.

RW How has the importance of streaming changed for radio?

Wasmer: Since I joined Triton in 2011, digital audio has become a much bigger part of their revenue. Broadcasters are now taking a more serious approach to it, and COVID accelerated that.

Streaming might account now for 12 percent of listenership on average, but in some cases, especially among the younger population, it could go to 20 or 25%. I have heard in Europe that some stations have up to 40% of listenership on streaming for specific shows. More recently we’ve seen a lot of investment in podcasting.

We’re trying to help make radio relevant to advertisers the same way that digital is relevant to them. Radio has

Below

Jean-Luc Wasmer



to transform. We've tried to bring the tools you might see on Spotify to the advertisers, saying, "You can run your radio campaigns the same way you run them with Spotify." Obviously, there are some limitations, but we've tried to bridge that gap.

Compared to a platform like Spotify, radio broadcasters traditionally didn't see the user's device as something they had to "own." They didn't look at it as being an important part of distribution that they were responsible for. But in the digital world, a publisher should control, if not the device, then certainly the software or the app, which provides a lot of signals, through cookies or mobile advertising IDs, that the people who buy digital want so they can overlay audiences or do attribution.

So we've got to figure out how we can monetize radio content and bring the same value even though we don't always have that control of an end user's device.

In that context, what can radio station clients do differently to compete better?

Wasmer: Having good metadata — a lot of it, and with good quality — is a first step. The precision of metadata is important. Ad insertion will be better as a result. We offer a [Radio Automation System User Guide](#) to help.

The second step is to control the end user's device as much as possible. Do what you can to get users to your website or on your apps. Rely less on third-party distributors.

Then pass along as much of your user data as you can to us, while respecting users' consent. We struggle sometimes to get publishers, including radio stations, to share basic data with us for advertising, which can have a huge impact.

What other developments should we know about? I saw that Wheatstone made its streaming appliances and cloud streaming software available with Triton's streaming protocol.

Wasmer: Yes. We think it is important to work with equipment manufacturers, because more radio stations don't want to have to deal with computers to do their streaming. We already had an integration with Telos Alliance for their Z/IPStream R2 device, and hopefully there will be more.

We've also improved reliability with [High Availability](#) streaming. This is a configuration in which multiple streams are available simultaneously, to provide uninterrupted service to listeners in the event of a break in connection anywhere between the station and the Triton streaming infrastructure.

Another priority is [brand safety](#), especially in podcasting, where content can vary so much, and there are so many podcasts and a lot of user-generated content. We coordinate with brand safety vendors that transcribe a podcast, analyze the transcription and rate it. This makes it easier for advertisers to target what they want or avoid content they

don't want to advertise on. It brings more confidence to advertisers that they can safely buy that inventory.

Where does audio processing come into the streaming discussion?

Wasmer: In general, a station should prioritize streaming and podcasting as they do their transmitter. This is something else that may not have been the case 10 years ago.

Make sure you have good equipment, including the processing. And if you do use a computer for streaming, it's fine, but please make sure it's a modern computer. If you knew how many environments we've deployed where a broadcaster provides a Windows 98 box ...

When we're doing ad insertion, we transcode the ads to match the specification of the streams and coordinate loudness levels so the end stream is consistent. So the quality is a shared responsibility.


I was going to ask you about loudness. You consult with the content provider? Is it up to them to provide it and then you match it to their level?

Wasmer: They tell us what loudness they want. We can recommend specific loudness levels. But this is configured on the platform.

When we get programmatic ads from buyers, they're not going to be normalized for a specific broadcaster, so we have to transcode everything, and we make different versions. When we need to insert an ad for a specific stream, we can match that ad to the exact specification of a stream.

When we onboard a new station, an implementation specialist will look at your station's setup and work with your engineers to understand what playout system you have and how the audio is going to come to us. If your engineer wants to do everything themselves, great, but most of the time, we're going to VPN into your machine and manage the settings. Creating the best ad insertion is something that is very important for Triton.

That's why the standard Icecast protocol was not good enough and we implemented our own proprietary protocol called MRV2, for Media Relay version 2, which is why we do those integrations with appliance manufacturers.

We capture the metadata at your facility, in the same box as our encoder, whereas some platforms send the metadata directly to the CDN and it's separate from your encoding. No matter what playout system you use, we [harmonize your metadata](#) so that when it comes out of our box, it looks the same, using our STWCue format. We time-align your metadata with the audio, to compensate for things like audio processing that may delay the audio a little bit; then we timestamp the audio and metadata, down to the millisecond, package them together and we shoot that to our CDN. So there's no misalignment. It's going to be perfect, the best ad insertion possible. 

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Streaming, no longer sidechained in the studio

It is quickly becoming a much more integrated, critical part of the radio operation

Rick Bidlack is a senior development and software engineer for [Wheatstone](#). He has a background in recording software development and served as an audio research and production technician at the Banff Centre for the Arts in Alberta, Canada, and visiting professor in the music department at SUNY Buffalo. He has a PhD in computer music.

RW What's one important thing you want broadcasters to know about streaming today?

Rick Bidlack: It's that streaming is no longer a sidechain activity. It's become part of the everyday in radio and it has become as important as perhaps the on-air signal.

At the same time, streaming is far more dynamic than on-air ever was, and we're dealing with a lot more protocols, types of metadata and more streams — and more opportunities for revenue. Every day, it seems, we're hearing about new ways broadcasters are using and

monetizing streaming.

Consider, for example, Triton Digital, which is making incredible advances in the area of programmatic ads and whose protocol we now support in our streaming appliances and software. Those kinds of partnerships between streaming at the operation level and streaming at the business level are rapidly taking place because streaming is quickly becoming a much more integrated, critical part of the radio operation.

RW Any suggestions for best practices?

Bidlack: Use the highest bitrate you can. The vast majority of devices out there are capable of receiving high-quality, high-bitrate streams, and the cost of doing so keeps going down. The higher the bitrate, the better your stream will sound. A 192 kbps AAC-LC stream sounds much better than a 64 kbps HE-AACv1 stream, which in turn sounds MUCH better than an MP3 stream at the same bitrate.

Above
Rick Bidlack



What recent developments in technical standards should we know about?

Bidlack: We're very excited about [RIST or Reliable Internet Stream Transport](#) as a solution for getting full-bandwidth streams from the production studio up to your FM or streaming processor running in the cloud, using the public internet — no dedicated fiber-optic required. We foresee more and more broadcast hardware and software being RIST-capable as stream transport into and out of the cloud becomes more commonplace.



How should broadcasters approach programming and managing streams these days?

Bidlack: Those who are most successful at streaming have been able to integrate streaming into the broadcast operation like any other audio chain, which is not always easy because streaming has its own standards and ways of doing things. They've managed to introduce streaming functions and workflows into the studio and do it in a way that's dynamic, so they can spin up or down streams as needed, add the right metadata and process the audio according to the laws of streaming.

With streaming, we're working with standards outside our industry and with various CDN platforms and digital media overall. In many ways, it's similar to AoIP in that we're balancing these two worlds, broadcasting and IP. As an industry, we've done an amazing job of integrating this otherwise foreign workflow into our environments.



How have you been able to integrate streaming into the studio environment more easily?

Bidlack: Because of AoIP, first by adding a streaming appliance to the AoIP network, then by adding streaming software to a server that's connected to the AoIP network and, finally, as software running on AWS — which is also an extension of the IP audio network. In this way, streaming is integrated into the broadcast studio like any other audio chain, with all the AoIP logic controls and routing needed for triggering stream provisioning from the talk studio, for example, or streamed directly from the studio automation system.



How important and complicated is the metadata part of this?

Bidlack: Automation systems pass on the metadata for artist and title of a song, for example, but whereas we have standards in broadcasting to display that information on a receiver, the same isn't true for streaming.

CDNs vary on how they handle metadata and so we've been using Lua transformation filters to adapt that metadata from the automation system to the CDN.

We've spent a great deal of our R&D on this one task, but this is an important step for broadcasting because it's becoming clear that metadata is going to become a lot more important as time goes on. Metadata is at the



We foresee more and more broadcast hardware and software being RIST-capable as stream transport into and out of the cloud becomes more commonplace.



center of being able to tailor ads to individual preferences, locations, times of day and so much more.



How critical is it that broadcasters use an audio processor made specifically for streaming?

Bidlack: It's probably the most important thing you can do after a high bitrate. We don't use the same processing techniques for streaming as we would for on-air because streaming has different requirements due to the idiosyncrasies of the streaming codec.


We now know that aggressive audio processing, the kind used in FM, for example, can increase the intermodulation and other distortion products that cause the streaming codec to make mistakes and remove or add frequencies that it shouldn't. A good audio processor made for streaming uses adaptive algorithms and other less extreme measures to create uniform loudness and control peaks.



You've said that streaming is likely to be the first practical use of cloud for many broadcasters.

Why is that?

Bidlack: Streaming on a cloud service like AWS seems to be a good fit, especially for those events like a concert or game because there's no hardware involved, it's fairly easy to spin up and tear down streams, and you only pay for the cloud services you use.

Streaming is likely to be the first practical use of cloud of all the broadcast applications for these reasons, but also because CDNs already have a cloud presence. It's not much of a stretch to originate streams from AWS or another data center. We introduced a cloud version of [Layers Stream](#) to give people that option. We're integrating streaming into the studio operation in a number of ways. For some that might mean having streaming take place in an AoIP appliance or as software on a server, and in some cases, it might mean they will actually be doing that in the cloud, where their CDN provider already is. Our goal is to make streaming a natural part of the broadcast operation. 

Streaming requires a different processing mindset

Jim Kuzman of Telos reminds us that with streaming, the competition is global and nearly endless

Telos Alliance Director of Content Jim Kuzman has been with the company since 2011. He has served as a technical writer, customer support engineer and content strategist before recently taking on his current role; throughout that time, he also has been part of the Omnia processing team.

RW What would you say has been the most notable change or evolution in the role that audio streaming plays in radio?

Jim Kuzman: In its early days, streaming audio was almost treated as an afterthought relative to the terrestrial signal. Bandwidth was costly and limited, both on the sending and receiving side. If the stream was processed at all, a spare Compellor was usually dusted off and pressed into service, and in many cases, the stream was fed from the main FM processor with less-than-optimal sonic results.

The adoption of smartphones and smart speakers has significantly changed how listeners consume content, which has worked in streaming's favor. Terrestrial broadcasting — “radio” in the most traditional sense — is still how most listeners tune in, but the gap is closing, and the percentage of the audience listening to a station's stream is increasing. This is true for in-car listening due to the ability to easily connect a smartphone to the vehicle, but even more so at home and at work.

Streaming has also taken on a utilitarian role as a backup STL of sorts, providing an additional means of getting audio to the transmitter for terrestrial broadcast.

RW What best practices will help deliver the best audio quality to listeners?

Kuzman: One of the most common mistakes is failing to treat the audio stream with the same care and consideration as the over-the-air signal. With OTA, stations are competing against in-market signals. With streaming, the competition is global and nearly endless. Listeners have enough choices and have heard enough well-managed, good-sounding streams that their

tolerance for annoying loudness shifts and sub-par audio quality is very low.

Regarding best practices for audio quality, it starts with high-quality, linear source material. This has always been true regardless of the distribution model, but it matters even more with streaming audio because the end product is delivered via a lossy codec.

From there, the stream must be consistent in terms of perceived average loudness, whether that's managed in the file domain prior to playout or with a real-time streaming processor. Just as we've learned in television audio, loudness shifts are off-putting to listeners, and they don't expect to have to adjust the volume between songs or when a stop set begins.

Next, the content needs to be reasonably spectrally consistent and sound polished. Developing a consistent spectral signature — a unique “sound” for the stream — is no less important here than with FM. This is where a processor like our recently released [Omnia Forza](#) really shines.

Unlike FM, however, there is no need to crush the dynamics of an audio stream with excessive compression and limiting since there is no need to build loudness. In fact, the goal of streaming audio is to manage and control loudness. Processing for streaming audio requires an entirely different approach and mindset from FM and affords the opportunity to back out of the loudness wars and enjoy much more dynamic content.

RW What should a streaming station manager know about loudness and LUFS?

Kuzman: LUFS, sometimes represented as LKFS, is a way of measuring perceived loudness over a given period of time using a frequency-weighted scale that approximates human hearing.

Digital television has relied upon such measurements for over a decade to help mitigate the problem of commercials that are significantly louder than the surrounding program. In short, ensuring that an audio stream is delivered with consistent loudness reduces listener irritation, invites long-term listening and makes for a much more pleasant listening experience.

Nearly all commercial streaming platforms have

specific LUFS requirements for their content providers, but with a few exceptions, the generally accepted value is -16 dB LUFS. The Audio Engineering Society has authored an [excellent technical document](#) — AESTD1008, “Recommendations for Loudness of Internet Audio Streaming and On-Demand Distribution”— that is a must-read for anyone wishing to completely understand LUFS in the context of streaming audio. It isn’t “light reading,” but it is clear and well-written. It is available at no cost from the [AES website](#).



And what should streamers know about clipping?

Kuzman: Clipping is a no-no in the world of streaming audio. In terms of audio processing, streaming processors rely upon peak limiting — often True Peak limiting — to prevent overshoots before the audio reaches the streaming encoder. However, that isn’t the last place where clipping can occur before the audio reaches the listener’s ears. Diving into the technical details is another (very deep) subject for another day, but in short, it’s essential to leave some headroom for downstream peaks. Depending upon the codec and bitrate employed, -1.5 to -2.0 dB is usually sufficient.




What should they know about encoding formats?

Kuzman: The two most common encoding formats for streaming audio are MP3 and AAC. Both are lossy codecs — that is, they reduce the size of the audio file (or, in this case, the amount of bandwidth needed to distribute and receive the stream) by throwing away data that, in theory, won’t audibly degrade the audio (at least at higher bitrates).

Audio quality is a highly subjective topic, and some people are much more sensitive to the audible artifacts of coded audio than others. At bitrates of 128 kbps or higher, most listeners struggle to hear the difference between MP3 and AAC. The differences become more evident at lower bitrates, where AAC pulls ahead in terms of quality and offers more encoding options.



Does it matter which browser the listener is using?

Kuzman: Nearly all web browsers for desktops, laptops, tablets and smartphones can natively decode an audio stream. When a listener clicks on a link to a stream on a radio station’s website, chances are that stream is going to open within the web browser. Some browsers do a better job at decoding than others, and the difference in audio quality is sometimes very apparent. If you open a stream and hear audible artifacts, don’t assume the problem is at the source or on the encoding side of the equation; try a different browser or, better still, a dedicated media player such as VLC. 

Below
Jim Kuzman



Virtualization expands your streaming options

RCS expands its toolset offerings for streaming and metadata display

Right
Philippe Generali

Broadcast software company [RCS](#) offers [Revma](#), a streaming package for radio groups. It provides an administration portal with customizable user management; listener reports per stream or aggregated for all sources; and multiple audio formats including HLS, MPEG-DASH, HTTPs and F-MP4. It is compatible with popular audio ad providers for inserting ads in streams; it works with all ad serving protocols and can replicate whatever the encoder is exporting, along with additional streams, known as relays, to create streams of various bitrates.

Philippe Generali is president/CEO.

RW **RCS calls Revma “an affordable and complete online professional streaming solution.”**

Philippe Generali: We want to be an end-to-end source for broadcasters and webcasters, a one-stop shop. We do it for music scheduling, automation, traffic, news — any tool people need at their station — so they have only one local person to call, whether they’re in China, Johannesburg, Paris or New York.

Revma is no different. We create music content with Selector, we play it out with Zetta and then with Revma we send the stream all the way to the listener’s player wherever they are.

RW **This is another product based in the cloud?**

Generali: The software is natively cloud-based. We have a CDN with several locations around the world, which makes it very reliable and allows us to offer failover; if one location has a problem you can switch to a different location seamlessly. In traditional broadcasting you never want to have dead air, and that’s now the rule for streaming also. The number one thing our customer wants is reliability, so we have all kinds of systems in place to detect anomalies.

We’ve also been leading the charge for the virtualization of sound processing. We work with companies like Sound4, Omnia and Orban to offer a software version of their processing for your streams. You don’t have to have physical equipment anywhere. The same with PPM and electronic ratings. We’ve helped build the cloud culture that has developed in the industry,



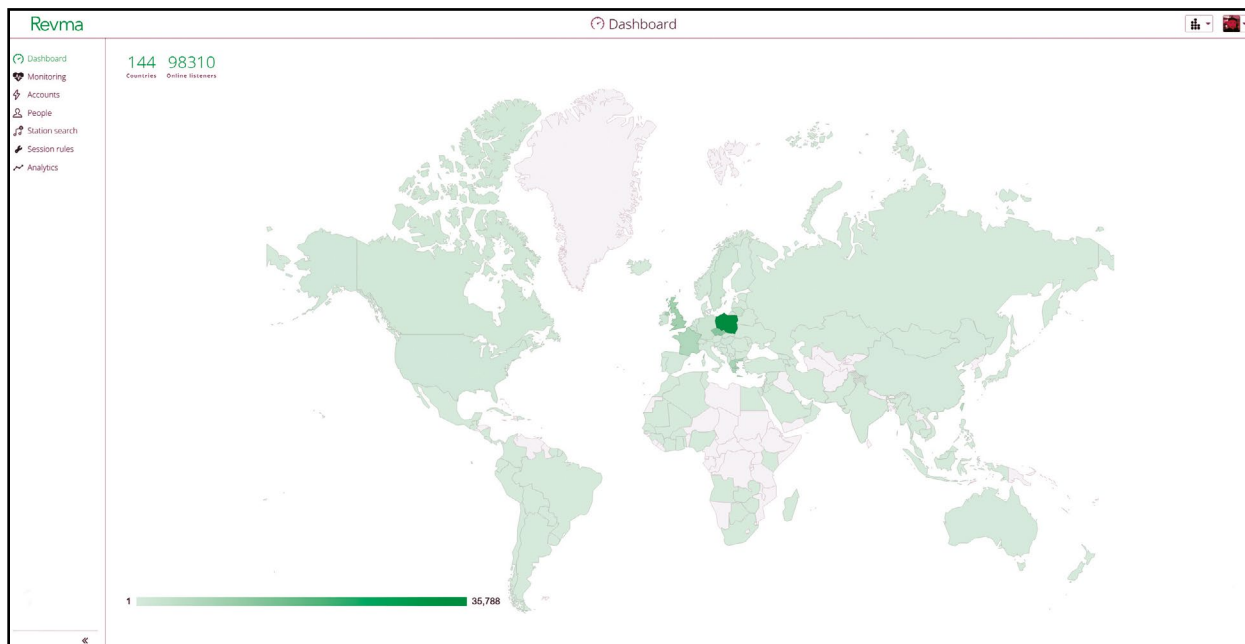
Now in a way we’re coming full circle because we have a pending product called Sound Center that’s basically an all-in-one box with containerized software that you place at your facility. It will do your encoding, sound processing and PPM.

RW **What’s the advantage of that, given everything we’ve heard about the cloud and its benefits?**

Generali: Some people want to prepare — to see how the cloud works and whether it’s reliable. As a supplier you want to go with your customers, at their own speed, in managing how they move to the cloud. So we can give it to them in a box first.

The bottom line is that there are many options. But virtualization helps the streaming world immensely, and with virtualization, services that used to be associated with hardware now are available on a monthly leased basis.

The Ecosystem of Streaming



Left
Sample user
analytics in the
Revma portal.

RW Are there best practices you would want readers to know about to get the most out of their streams?

Generali: Metadata is important. I think it was Fred Jacobs who said you want to look as good as you sound.

We're also introducing a service called Audio Display. While not directly related to the topic of streaming, this allows a broadcaster to send impeccable metadata, with proper album art, proper spelling of title and artist, all matching whatever platform you display it on. It's great in the car, where your station needs to look perfect because you are being compared to Spotify and other music platforms.

Audio Display works with RDS and HD Radio, so you can create a new revenue stream. And you can display an advertiser of your choice during a commercial break, not necessarily the one that's on the air. You might decide that your entire break will be sponsored on the display of the car by 1-800-LAWYER — "If you've had an accident, call us at this number and we'll take care of you." That can be a significant source of revenue.

iHeartMedia uses it across its terrestrial and HD channels but we're offering it to the entire industry.

RW Would you agree there has been a significant increase in consumer uptake of radio's streaming output?

Generali: Yes, by all measures. The industry in general is doing very well. IP audio and personalized advertising on streams really attract digital buyers.

Streaming used to be an appliance that allows a station to be on the internet. Now, not only has it now been virtualized, but you can know exactly how many listeners you have, at any second, on your stream. We can match

that against your log to see if there's a trend — whether a particular song gets a lot of skips, or whether three songs in a row of a certain type causes people to tune out or give you more retention.

It's easy to offer premium channels too. For instance Bauer Media in the United Kingdom came to us early on and said, "We want to do something groundbreaking for streaming live content. We want to let the listeners skip a song." So we built a little delay into the stream. With music, nobody's really listening to the FM and the stream at the same time; it's not time-sensitive as in a sports event.

We let the listener skip a song and insert a compatible replacement song chosen by Selector based on the criteria of your station, such as the last time the artist played. When the song is over, we stitch back. This allows a listener to tailor their music a little bit, and it's another way for a music director to do some research. Bauer offers a premium stream that allows the listener to do this. It will mostly appeal to P1 listeners, who are giving you their feedback both actively and passively.

In the same vein, if you can skip a song, you can skip a spot; so you can offer premium channels where listeners can do that. Or you can insert spots. You may have a three-minute break on your terrestrial, but because we know how to stitch back, you can have a two-minute break or a four-minute break; you can maximize the stream based on the listener.

At the end of the day you want to make it sound good. As recently as five years ago, the sound volume of streaming commercials would suddenly collapse or blast through the roof. Those days are over.

[Watch a presentation by Nate Mumford of RCS on technical considerations of Revma and its available analytics and reports.](#) **RW**

Make the move to HLS

Greg Ogonowski says it's time to reinvent using better tools

Writer



Greg
Ogonowski

President

[StreamS/
Modulation
Index LLC](#)

More than 20 years ago, delivery of media content on the internet was well on its way. Initially, audio was much easier to deliver than video because of its lower bandwidth requirements and the slow internet of the time. Yet video received most of the attention and technology investment, becoming a streaming power and feeding the cord-cutting that we know today.

Meanwhile, terrestrial radio audio streaming was viewed at first as a giveaway perk on station websites; it simply was not taken very seriously. Consequently the streams were based on amateur streaming audio protocols and were plagued with poor reliability, poor metadata, poor ad insertion, limited features and security issues.

This was not a professional approach. Unfortunately such streams remain the majority of what is available today, delivering a user experience that generates very low expectations.

It doesn't need to be this way.

While all this was happening, huge advancements in mobile devices made delivery of reliable, feature-rich, high-quality audio streams possible.

Automobiles now take these mobile connections to their digital dashboards for an audio experience with unprecedented audio quality that tops any terrestrial or satellite broadcast, analog or digital, since there is no narrow audio bandwidth AM, pre-emphasis/de-emphasis FM, or poor audio codecs for digital and satellite radio to contend with.

Unlimited data plans are now the norm, so mobile streaming cost is no longer a consideration. Furthermore, these mobile devices are carried with everyone, everywhere they go. It is the new transistor radio — this time with billions of transistors!

Moving forward

Things have now really changed. Terrestrial audiences are shifting from over-the-air delivery to mobile devices and computer media delivery. A growing portion of your revenue now depends upon internet streaming. Listeners are purchasing expensive mobile devices, and they expect features and performance from them.

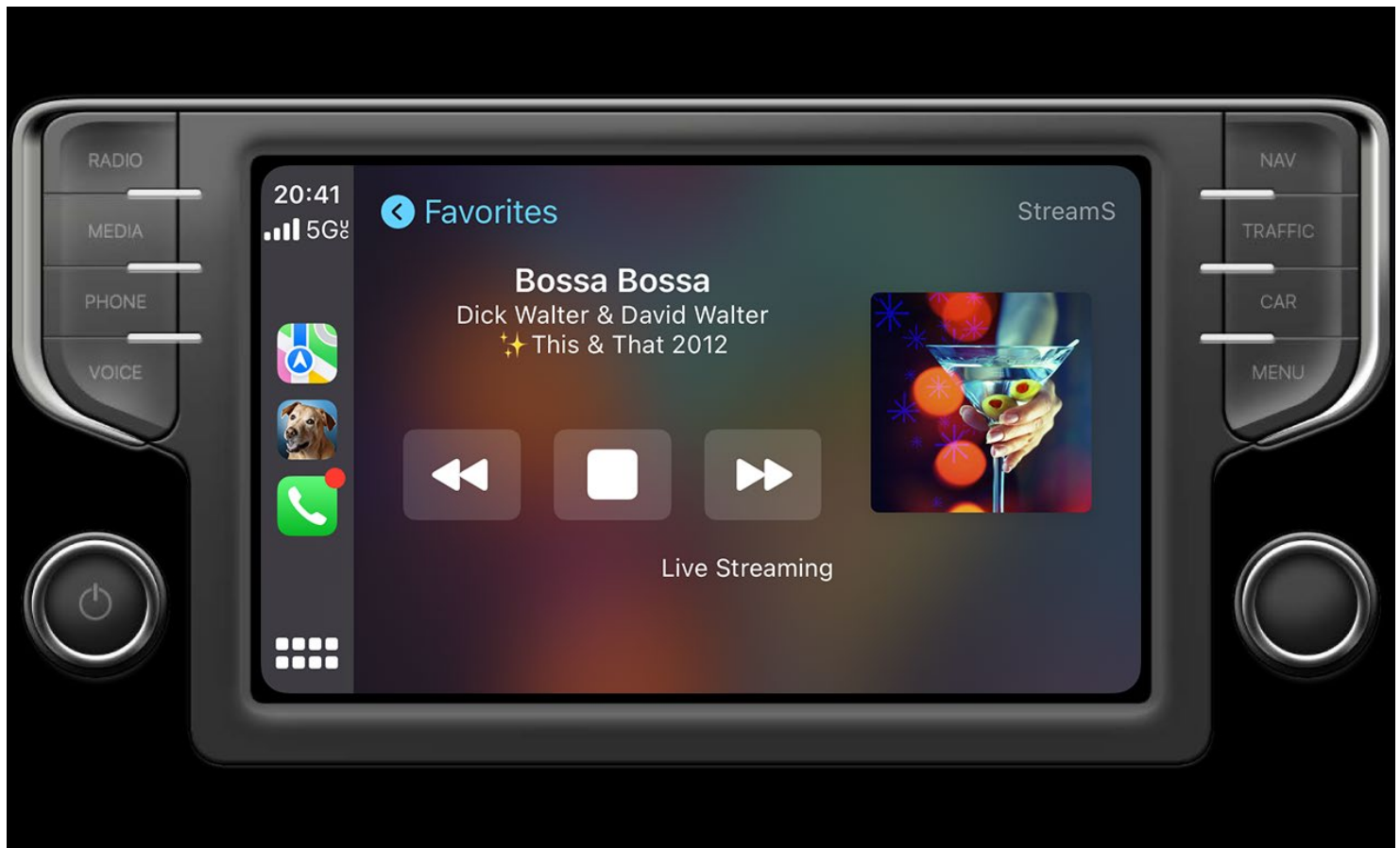
In order to reach these new devices and give this audience what they expect, new streaming methods and protocols are used. Old legacy MP3 streams no longer cut it. Just as video streaming has moved to segmented streaming to survive, audio can benefit from the same change, but it must be done correctly. HLS is just that protocol to deliver.

[HLS \(HTTP Live Streaming\)](#) is an advanced streaming protocol that works very differently than traditional legacy streaming. It uses segments or file chunks instead of a constant data stream, which ultimately causes reliability issues. Streaming using segments works like the internet works. Contrary to popular belief, the internet was never designed for persistent, constant data connections. So HLS leverages the way website content is delivered for a highly reliable streaming experience.

HLS has much more to offer, and it solves all the shortcomings of legacy streaming:

- More professional features
- Lower deployment cost
- Lower operating cost
- Higher performance
- Higher availability
- Higher scalability
- Higher reliability
- Higher security
- Higher quality

“Huge advancements in mobile devices made delivery of reliable, feature-rich, high-quality audio streams possible.”




However, since HLS is a broad specification, many details need to be right to get the best performance. Unfortunately, there are already a few content distribution networks offering poor implementations of HLS delivery. These usually include some sort of transcoding of ICY streams, asynchronous metadata with timing issues and no support of newer HLS fragmented MP4 (fMP4), which supports lossless and new xHE-AAC/USAC streams. Multi-channel surround streams are another consideration. So vet your CDNs carefully to get the most value for you and your audience.

To achieve the best possible HLS, avoid using legacy streaming encoders, and choose a true segmented streaming encoder. This outputs encoded segments with assembled synchronous metadata, which is always on time, and uploads and manages files and directories on the server with optional multiple synchronous bitrates.

This provides on-time, now-playing metadata, precise commercial/content insertion and optional control commands for external software and hardware. A simple web server or cloud storage can be used to deliver live and file (on-demand/podcast) HLS. Special, expensive dedicated streaming servers are no longer required or even desired. This ultimately lowers streaming costs, increases reliability and quality, and allows static content to be delivered by the same server, if needed.

StreamS HLSdirect Live and File [Encoders](#) and [Systems](#) support all of this. They are enterprise, commercial-grade and based on open standards to reach the largest possible audiences.

In summary:

- Today's audiences consume content on a plethora of devices, both fixed and mobile. They experience video streams that "just work" and they expect the same from audio streams. They have no patience for dropouts, disconnections, poor audio quality and error-ridden, mistimed "now playing" metadata.
- Yet many current audio streams still have these problems, along with sparse audiences. They have blown their "one chance to make a first impression." It's time to reinvent using better tools.
- The simplicity of old-school streaming is a trap. Without professional audio processing to provide broadcast-quality audio and direct HLS streaming to ensure uninterrupted reliability and rich metadata, audio streaming is a second-rate product destined to fail. Audiences expect better for their expensive, feature-rich capable devices and have an abundance of other entertainment choices.
- Adapt or die! There is no better audio entertainment return on investment than well-processed, modern HLS streaming. And, unlike terrestrial broadcasting, netcasting covers the world in hi-fi! 

Above
An Apple CarPlay dashboard screen with advanced "now playing" metadata with extra fields and extended characters.

Modern processing and monitoring makes a difference

Dan Grimes describes the setup at SOS Radio Network

SOS Radio Network has seven transmitters and a dozen translators covering the Mountain West, including its flagship KSOS(FM), a 100 kW ERP station in Las Vegas on 90.5. The network, part of Faith Communications Corp., also has a dedicated mobile app and can be heard on

TuneIn and other aggregators.

Dan Grimes is responsible for radio broadcast maintenance in the southwest region.



What role does streaming play there, and what is the audio chain?

Dan Grimes: Our streaming is popular. We promote it and our app. Our mission is to share the gospel of Christ through music and teaching, so we want as many people as we can to listen. At any given moment, around 500 people are streaming live; they are primarily in North America, but we have listeners worldwide.

Below

Dan Grimes



We've gotten over the minimum SoundExchange cap, so we have to pay per-listener, per-song, and keep track of those.

SOS Radio is listener-supported, we don't have contracts with anyone. We want to be free of anyone telling us what we can and can't put on air, so we raise money from our listeners through pledge drives.

When I came on five years ago, our playout server put out a stream to a distribution amp, where one feed went to the air processor and another went to a Symetrix box to keep streaming levels even. And we do two feeds so when a listener to the website has high bandwidth, they get MP3, but when they're on their iPhone on cellular, it automatically switches over to the AAC and lower bit rates. At the time, a Barix encoder would do an MP3 stream while a DEVA Broadcast sent AAC+.

But then we got an [Omnia.9 processor](#), which is licensed for three cores: FM+HD1, HD2 and HD3. We wanted our satellite network to get different processing so we use HD3 for distribution; we use the HD3 core for processing for the satellite network and for our streaming.

Our processing is very mild. We started with Omnia's Reference preset, which was really nice. And the processor has embedded encoders, so now the .9 sends the streams to our CDN [ChristianNetcast.com](#).

Our audio got much louder when we went to the processor. We do watch [LUFS loudness levels](#). SOS Radio does well not because we have a lot of listeners but because they listen a long time, hours and hours and hours on end. With that in mind I don't need to be the loudest. I want audio quality first, and then to be nice and consistent.



How do you monitor?

Grimes: Well, first of all, our GM listens to it a lot. (Laughs.) We do try to have ears on it as much as possible. And we use an Inovonics box. Their original version was the 610, which we have, but the new 611 is nicer. SSL or Secure Sockets Layer streams are now required for most streaming services, and it tends those. The 611 also has metering and graphing. And it can rotate among multiple streams, so we don't need a monitor for every stream and bitrate. I set it on a 10-minute interval and it gives me alarms when one goes silent.

In fact I put the 610 on one ISP and the 611 on the other. If I get an alarm from one, I know it's an ISP that's the problem; if I get alarms from both I know that streaming

is the problem. It's kind of weird to monitor from different ISPs, but they do drop out a lot.

RW You have redundant ISPs.

Grimes: We have over-redundancy! We had Cox hybrid fiber cable, but it would go down all the time, especially between 2 and 5 a.m.; I don't know what people were doing on that line but it would just get hammered. Cox suggested an SD-WAN from their company RapidScale. Now we have a fiber circuit and a hybrid fiber circuit to coax cable, and for emergencies we have CradlePoint on Verizon.

The stream goes out to RapidScale, which determines the best link and then sends it over the internet. So we have redundancy going out. We've lost that hybrid fiber cable many times but the streaming has never gone down because of it, except once when a fiber was cut, back at the firewall.

What I don't have is redundant audio out of the studio to our content distribution network. ChristianNetcast does not support multiple audio streams and splicing. I wish they did.

We contract with [National Public Radio Distribution Services](#) for our satellite distribution; for our feed to NPRDS we're using GatesAir IP Links, which do have redundancy. I have two streams going out. One's going over Cox, another over a Lumen Fiber. So not only do I have that SD-WAN, which has three different paths, but I also have Lumen Fiber. If all of Cox goes down, the Lumen Fiber picks up. For our satellite distribution, the IP Links have dual paths, and they do packet splicing to pick up whichever packets get lost.

But if we lose packets going to the CDN, our customers get dropout. And that does happen.

RW Is latency an important consideration for you?

Grimes: I don't think so. Our AAC is a lot more delayed but it doesn't really "switch," in my experience; instead it disconnects and reconnects. So when you're going from high bandwidth to low bandwidth as a listener, there's a big break.

Jitter would be more of a concern. As long as the latency is consistent, audio flows cleanly, but as soon as you have jitter — where latency is changing, from short to long latency — you're going to have a dropout or a skip. And that does happen.

Our paths aren't dedicated circuits, and they change once in a while. When they do, there could be enough change in latency to hear it. It's usually once and short, not a big deal.

RW Tips or things to avoid?

Grimes: Of course keep up your quality; get the best processing, the best level control.

That's one of the reasons we got that Omnia.9; it has a repair algorithm that restores peaks and dynamic range and removes distortion from source material. For some



reason, many music distributors want the music to be "louder" and simply apply gain to the beautifully engineered music. But when they do this, they often hit the digital maximum (0 dBFS) and it clips the peaks. What once were sine waves become square waves.

When the square waves are put through a Fourier transform to put them in the frequency domain, part of the process to allow data reduction (aka compression), it requires a much greater number of sine waves to accurately reconstruct the clipped audio. Theoretically, it takes an infinite number of frequencies (sine waves) to make a square wave. Obviously, this is impossible to compress. So by first processing the audio with and reconstructing the clipped audio into nice sine waves, the compression algorithm can compress the audio much more efficiently and accurately. The result will be better sounding audio with a lower bitrate.

Also keep in mind that our ears and our mind get more fatigued if we listen to audio that is unbalanced with too much bass or treble. While we might like it initially, it can be irritating to listen to long term. It is better to be mild in bumping up the lows and highs (the opposite of "equalization").

Last, it has to be reliable. People may watch TV in the background for an hour; but with audio, people listen all day long, and they're going to notice every little grit glitch and failure. Make sure your path to the CDN is super reliable. **RW**

Above
SOS promotes its various listening options on its website.

Thoughts on getting the most from your stream

These technologies have brought big changes to our industry

Writer



David Bialik

Consultant and former director of stream operations for CBS Radio and Entercom.

As we've learned in this ebook, traditional media have undergone an inadvertent overhaul during the past decade, with streaming becoming the prevalent method of media transport. Broadcasters and other content providers are utilizing streaming technology to move content within production and broadcast. This is common in both audio and video mediums.

Streaming has lowered audio transport costs. No longer do you need equalized lines from the phone company. Microwave links slowly are going away. Many companies are trying to move from expensive satellite distribution. Radio networks are moving quickly to IP solutions to distribute their content, as is television. The public internet is far-reaching; it's hard to find a location that does not have some network connection.

Many broadcast companies are setting up network operating centers or NOCs to control their stations; the content can be distributed by streams. Also, everything is monitored by streams; and control and telemetry is being done by IP.

Yes, after years of going wireless, we are moving to wired technology.

The advent of [Secure Reliable Transport](#) has accelerated this technological revolution. SRT is a royalty-free, open-source video streaming transport protocol that delivers secure low-latency streaming performance over the public internet. The latency is lessened to a workable state by lower packet loss. Streaming can now be secure via end-to-end security with AES 128/256-bit encryption. This has allowed a reliable low-latency solution. There are other technologies but this is common.

Another technology that you may hear about is [WebRTC](#), an open-source project that enables real-time voice, text and video communications capabilities between web browsers and devices. This technology lessens latency but does not eliminate it. It is seen in STL, remote and studio utility applications, but cannot support streaming to large audiences.

The goal for most streaming content providers and distributors is to eliminate latency. Good luck! As most readers will know, every stop in a digital chain that involves processing adds latency. For example, any digital signal processing will add to the delay. Yet those stops are needed to make content presentable, so latency is inevitable at this time.


From your stream source, the content is distributed by a Content Distribution Network. Think about it as a giant distribution amplifier that creates one-to-one connections to the audience.

The transmission is also dependent upon the public internet. How many hops is the stream going through?

Another latency issue is on the reception side. How is the network there? Are there many switches in the network architecture?

A plus for streaming is that the streamer can control how the product is presented, through metadata. Metadata can control how a stream player works. It can control the audio levels, loudness and video aspect ratio among other things. For audio-only streams, metadata also allows for title and artist data and display. Metadata can allow the communication for interstitial cues, as calls to advertising networks to personalize commercial breaks (is this good?). The only limit to metadata is what the stream player will allow. Many stream providers try to control what player is used. Usually the metadata is running within the data stream.

Since presentation is important to the broadcaster and the advertiser, metadata is crucial. "Now playing" information is fed into the metadata from a middleware service provider. Artwork is fetched from another service provider. If ads are injected into the stream, they are being called from the metadata. Do not underestimate the importance of the metadata!

The above discussion and the other articles in this ebook demonstrate why the stream should not be ignored. If your station is going to stream, don't go halfway. Remember that you will always be compared to the bigger companies. Your listenership expects at least the same experience. 

“Yes, after years of going wireless, we are moving to wired technology.”