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Radio and the software-based air chain

Paul McLane
Editor in Chief

More and more of the radio broadcast air chain is now based in software, but so far this process has been largely piecemeal.

Nautel has envisioned a more integrated approach, creating an FM+HD transmitter receiving all of its modulation content over a synchronous IP link back to a cloud-based or server-based air chain that allows resiliency via changeover to a backup air chain or air chains. It has partnered with Telos Alliance to validate and advance this approach.

Meanwhile, broader industry efforts have made it possible for manufacturers to embed Nielsen PPM encoding software into their own products, and work continues to make the same thing possible with EAS equipment.

In this ebook:

- Philipp Schmid and John Whyte discuss Nautel's efforts to make the implementations of digital radio easier and more affordable.
- Geoff Steadman of Telos Alliance writes about the benefits of virtualization and how Telos has taken it into account in its strategic product planning.
- Nick Mannion explains how Nielsen's Audio Software Encoder decouples the PPM encoding algorithm from the Nielsen hardware encoder and makes it available for integration into third-party broadcasting equipment.
- Joe D'Angelo and Jeff Detweiler of Xperi describe the multi-year effort to move the pieces of the HD Radio system into a cloud-based architecture.
- Philippe Generali of RCS writes that the RCS software ecosystem solves content creation and delivery challenges, providing radio broadcasters the benefits of an integrated approach.
- And in a notable white paper, Bill Robertson and Ed Czarnecki of Digital Alert Systems explain a new concept called "EAS at the Edge," which has just launched in collaboration with Nautel and Telos.

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THIS ISSUE

"We're moving from talking to walking"

Nautel begins to implement the concepts it has been demonstrating

Right
Philipp Schmid and John Whyte

Over several recent NAB Show seasons, transmitter manufacturer Nautel has highlighted software-based air chains. It has explained the potential benefits to broadcasters including the simplification of infrastructure, a reduction in the number of hardware devices, the ability to create standby air chains and the elimination of HD Radio blend issues.

With the introduction of its latest FM transmitter line, Nautel says these ideas are now practical. We talked with Philipp Schmid, the chief technology officer of Nautel, and John Whyte, the company's head of marketing and product strategy.

Philipp, what is meant by the term "software-based air chain"?

Philipp Schmid: The root is in software-defined radio — the idea that we can move away from dedicated hardware into generic software blocks for modulation, audio encoding, multiplexing and IP transport.

We'd been designing digital radio equipment around software for a long time, but we chained it to dedicated embedded systems and hardware platforms. With a software-based air chain, we're separating this hardware dependency, using general-purpose compute platforms to host the components that we'd had in dedicated hardware.

Someone who has been out of touch living in the woods for the last 10 or 20 years might hear that and say, "I know what an air chain is. It's a console that feeds an STL, there's a processor and a transmitter." So what's different?

Schmid: We look at the transmitter as the end point of the air chain before we enter the RF domain. Within the transmitter we have the exciter, which handles signal up-conversion, peak power reduction, precorrection and control, all of which will need to remain embedded firmware closely coupled with the transmitter hardware.

The software air chain end point within the transmitter is the signal modulation or signal generation. We now have pure software implementations of FM modulators, the HD Radio Exgine modulator, as well as DRM-FM and even DAB modulators, without the need for embedded hardware. By using standard compute platforms, we can install the right software modulator for you as a software module … or app.

The person living in the woods may not be aware of the increasing pace of change in our industry that will quickly obsolete yesterday's purpose-built embedded systems, not to mention supply chain problems. Software modules can

be kept up to date with emerging changes, and standard compute platforms are replaceable.

Furthermore, 10 to 20 years ago audio over IP was only just emerging; now it is commonplace. In fact, IP connectivity is a cornerstone of the software air chain, and we are taking it to the next level by feeding the software modulator over IP, as well.

Our FM modulator can be fed via composite MPX, our Exgine modulator operates on the E2X protocol, our DRM modulator consumes the MDI protocol and DAB uses EDI. In all cases the modulator is fed by a multiplex of audio and data streams generated by a multiplexer, such as the exporter/importer for HD Radio, the content server for DRM, the DAB headend or the stereo generator within an FM audio processor. Again all these components are available as pure software modules including the audio processor

Audio over IP comes into play at the input to the multiplexer, which often is coupled with an audio encoder that converts PCM audio to the HD codec or AAC codec, depending on the standard. Livewire+/AES67 AoIP is the input to our Omnia for Nautel audio processor that we coupled with our Gen4 HD Radio importer solution and together feed our FM+HD modulator.

A picture emerges of software processing blocks interconnected via IP streams. Where should we go next in our software air chain? Audio mixing engines? Studio automation? Emergency alerting?

John why would a broadcaster care about this?
John Whyte: About 15 years ago we began thinking about the larger ecosystem in which our transmitters operate. Why wasn't RDS part of the transmitter? What about audio processing? Could we put processing in our low-end transmitters? What about web browsers and diagnostic control? What about instrumentation?

As we started putting these capabilities into transmitters, broadcasters said, "Yes, that's the right way to go, I don't want the extra boxes, I don't want the extra wiring." And as you get rid of complexity, you're also generally getting rid of cost.

Also, people who enter broadcast engineering now tend to have more of an IT bent. Getting rid of boxes finds favor with those folks. So we're building our approach based on what we're hearing from broadcasters, the trend towards consolidating functionality, and with offerings reflecting the innovative opportunities that modern software-based approaches allow us to create.

Schmid: We should also mention the ability of broadcasters to have multiple air chains for a whole new spin on redundancy and resiliency. When it's all in software, the entire air chain is cloneable, which is impossible with hardware unless you own a factory and deep pockets. But with a software-based air chain, you can clone it, you can have an air chain in the transmitter, you can clone it into a virtual system, you can clone it into the cloud or your own data center; and you can have multiple copies of it.

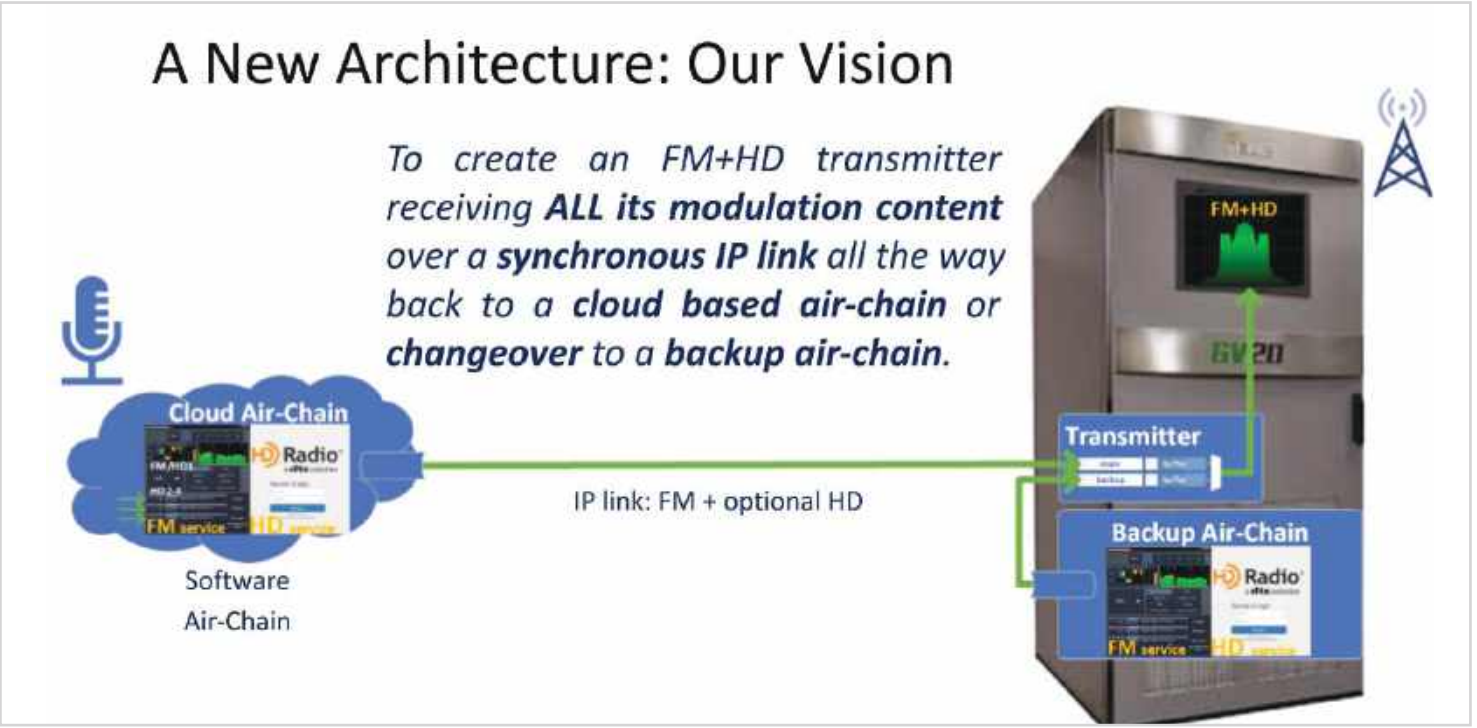
> **Now we can see an entire ecosystem from ingest playout all the way up to modulation — that's our software chain.**

Then it comes down to software licensing. How many do I want to have active at any point in time? Perhaps you have multiple air chains but only one is active — you're only consuming one license, but if anything changes you just use the other air chain. Or if any part of that air chain is compromised, you get rid of it and go to a new one — you revert to a backup, to a known "good state."

This topic seems interlocked with digital broadcasting, specifically. Why?
Whyte: As we looked to putting the air chain inside the transmitter, the first target we chose was to tackle the toughest problem we saw for broadcasters, which was the process of putting HD Radio on the air. It involved a lot of separate components and boxes. It also means managing the FM-HD blend issue. The industry had wanted for a long time to sync up the FM and HD signals so that FM and HD drift can be eliminated and achieve a common transport. All this argued for us to make HD Radio our first target. And our solution eliminates the blend issue.

Schmid: Digital broadcasting offers multiple audio services in a single broadcast transmitter — HD1 to HD4, for HD Radio. Think of it as multiple air chains per transmitter ideal for scalable software air chains. We have four processing cores in our Omnia for Nautel audio processor, with multiple Livewire+ inputs extending each air chain towards playout and studio automation. While software air chains apply to analog FM as well, they have greater impact with multiple digital radio audio services.

To be clear, though, the discussion about software-based air chains applies beyond HD Radio, yes?
Schmid: Absolutely. It applies to analog FM just as well as, to DRM and DAB, and could even extend into our AM transmitters. As mentioned, all respective modulators are fed a multiplexed stream over IP, all require audio encoding and audio processing. While we focus on HD Radio with



Above
A promotional image from Nautel depicts the basic concept.

four audio services first, we see this concept rippling into other application areas as well.

You've discussed many of these concepts before, so what is new this year?

Schmid: Several years ago we announced a partnership with Telos Alliance and demonstrated time alignment and the idea of being able to move the audio processor and importer/exporter virtually anywhere while maintaining HD diversity delay time lock.

Then two years ago we demonstrated the concept of feeding a transmitter from the cloud, such as AWS. Last year we showed that because we have this common compute platform right in the transmitter, we can have *everything* right in the transmitter. And no matter where the feed is coming from, if a link fails, it can switch over to an internal air chain in a GV transmitter.

This year we're shipping our GV2 line, so the base platform is rolling out. It will allow you to add the software modules of the Exgine modulator for HD Radio, it will allow you to add the audio processor and the Gen 4 importer or exporter as software modules. So it's getting real. We also now can integrate EAS into our air chain through our collaboration with Digital Alert Systems, described later in this ebook.

Simplifying the HD Radio air chain is a key aspect of what we're doing, so as time goes on, we hope to integrate more and more software or configuration aspects into our own user interface, to provide a common point for configuration and troubleshooting, rather than the user having to go through multiple interfaces.

Whyte: We've had a dream for at least a decade about how to make the benefits of digital broadcasting more accessible to a broader audience of broadcasters. So part of our news this year is that we're trying to lower the barriers to for broadcasters to market test HD Radio.

Nautel and others in the industry have discussed how to motivate the next 1,000 to 2,000 stations to adopt HD Radio, whether in medium markets or those within major markets who haven't yet felt compelled to do it.

So we've introduced something called the HD Digital Radio Test Drive. If a customer is looking at replacing a transmitter in the next few years and hasn't run HD in the past, they now have an cost-effective and technically straightforward way to put HD on the air , test it for up to six months and see if they can achieve the results of new listeners or new revenue and new services.

The customer will still need to buy a transmitter, we can't make that requirement go away; but because we've turned the digital radio air chain into a software load, the infrastructure now exists for broadcasters to just drop an HD air chain into the transmitter. Now we can create a trial period at minimal cost, without the complexity of hardware, wiring and boxes, and with minimal capital costs.

So stations can put digital radio on the air, including audio processing. All they need to do is feed content to it and they can be broadcasting a whole suite of HD, with multi-channels if they wish, for up to six months.

It gives them an opportunity, without massive

Left
Stingray Group station CFRQ(FM) in Halifax, Nova Scotia, has installed the first GV2-30 transmitter and has adopted the software-based air chain approach. At left is Matthew Gillie, director of engineering in Nova Scotia.

investment, to light up dashboards in their market, to initiate advertising, to air special events or a local basketball tournament or a seasonal format on an HD channel. All those things are possible when you can just turn on a station for a few months to see if it gets traction.

Schmid: In some international markets such as India, a test drive program is perfect. If broadcasters are unsure if there's a business case for HD Radio yet, if receivers aren't quite there yet, you may not be willing to invest; but a test drive allows you to get started with HD with minimal investment and grow with the market, as receivers become available and the business proposition starts to make sense.

Are there common misconceptions about software that you'd like to dispel?

Whyte: Sometimes there's a perception that systems based on embedded-fixed purpose boxes are superior. It probably goes back to the early days when HD implementations were basically on a consumer PC with a consumer operating system. Today a lot of mission-critical medical, banking and broadcasting applications are software-based, with proven uptime reliability and offering the flexibility and accelerated innovation that only can be achieved in software-based implementations.

Schmid: There's the perception that embedded systems, and systems based on open platforms, are more secure from an IT security point of view. That is absolutely not true.

There's a saying in the industry: Obfuscation is not security. Just because you don't see what's happening in the embedded system doesn't make it any more secure; it's actually more dangerous. If a malicious actor gets into an embedded system, you may not even be aware of what they're doing. In an open system, you're more likely to catch what's going on. Even in embedded systems, hackers can live undetected for a long time.

Can you give examples of broadcasters deploying an air chain as you've described?

Schmid: A top local station here in Halifax has embraced the approach and installed the first GV2-30. It's a 20 kW station that went on the air with our traditional HD Radio approach, and now we have changed them over to the air chain approach, which is working really well.

Also, KVSC(FM) at St. Cloud State University in Minnesota has installed the first GV2-10 and is on air using our software air chain approach on four HD channels.

More are lined up for deployment in the coming months.

What else should we know?

Whyte: You asked earlier what's the difference between this year and last. We've talked about things like EAS and our test drive program. But the biggest theme is that we're moving from talking to walking. We were demonstrating concepts in the past. Now we're productizing the code and productizing the hardware. And it's just the beginning for what we'll be able to offer in the future via our software-based approaches, coupled with proven transmitter platforms.

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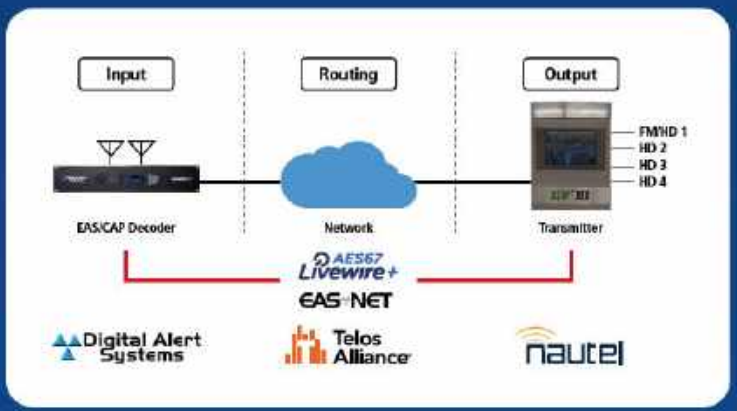

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Why a virtualized air chain makes sense

The broadcast industry can be described as "mid-transition" right now

Writer

Geoff Steadman
Telos Alliance

Virtualization is a hot topic, not just in the broadcast business, but in scores of industries.

Years ago, Telos Alliance made the strategic decision to migrate our solutions to virtual models that leverage the IT industry, the internet, ubiquitous computing, state-of-the-art cyber security mitigation and open standards and practices.

In a sense, this is a continuation of the revolution we started with the invention of Livewire AoIP over 20 years ago. As we have reworked our software tooling, we've realized a huge benefit: A common code base can be used to produce both virtual offerings and bespoke hardware.

To suggest that virtualization forces a choice between offering products as hardware vs. software misses the point that underlying software tooling can be the common denominator to both. Our industry needs both.

Borrowing a term from the civil engineering world, the broadcast industry can be described as "mid-transition," with infrastructure moving from its single-function hardware past to an interconnected IT-based future.

The service life of various equipment, hard costs for broadcasters and shifts in skill sets associated with new tech naturally constrain the speed of this transition. The coexistence of old and new technologies is a necessity, as neither market forces nor regulatory shifts have an instant effect; Telos takes this adoption arc into account in our strategic product planning.

But if there is anything we learned from the pandemic and global supply chain disruptions, it is how fragile certain assumptions are, particularly with regard to the "just in time" parts availability we took for granted for so long.

In dozens of cases, we have seen key components go end-of-life with no warning, or get assigned 52-week lead times. This forced many companies into expensive redesigns and shipping delays, leading to disappointed customers and stalled projects. With those realities in mind, virtual products don't just look like a parallel development path, they become a lifeboat.

When we say "virtualization," we simply mean deploying familiar products on IT-based hardware rather than on proprietary, purpose-built hardware. This can be accomplished locally with commercial off-the-shelf (COTS) servers, our newly introduced AP-3000 pre-configured platform for software services, products like Broadcast Bionics' Virtual Rack, or by using cloud-based hosting services like AWS (Amazon Web Services).

Compared to dedicated hardware, virtualization offers many benefits, including:

Scalability. Customers can spool up more instances of our products in software, then throttle back if needs change. This freedom can be leveraged by clients "at will" to manage growth, special events, and new business models.

Integration flexibility. Incorporating virtual products isn't an "all or nothing" prospect requiring a complete facilities overhaul; it can be done in stages and coexist with a customer's current facility and infrastructure, especially as AoIP building blocks are commonplace in so many facilities.

Remote management. Software updates can be performed remotely (including over the internet) rather than requiring on-site visits to remote locations. System functions and health can be more efficiently monitored from a corporate NOC; technicians can securely remote into complex systems and troubleshoot problems from thousands of miles away.

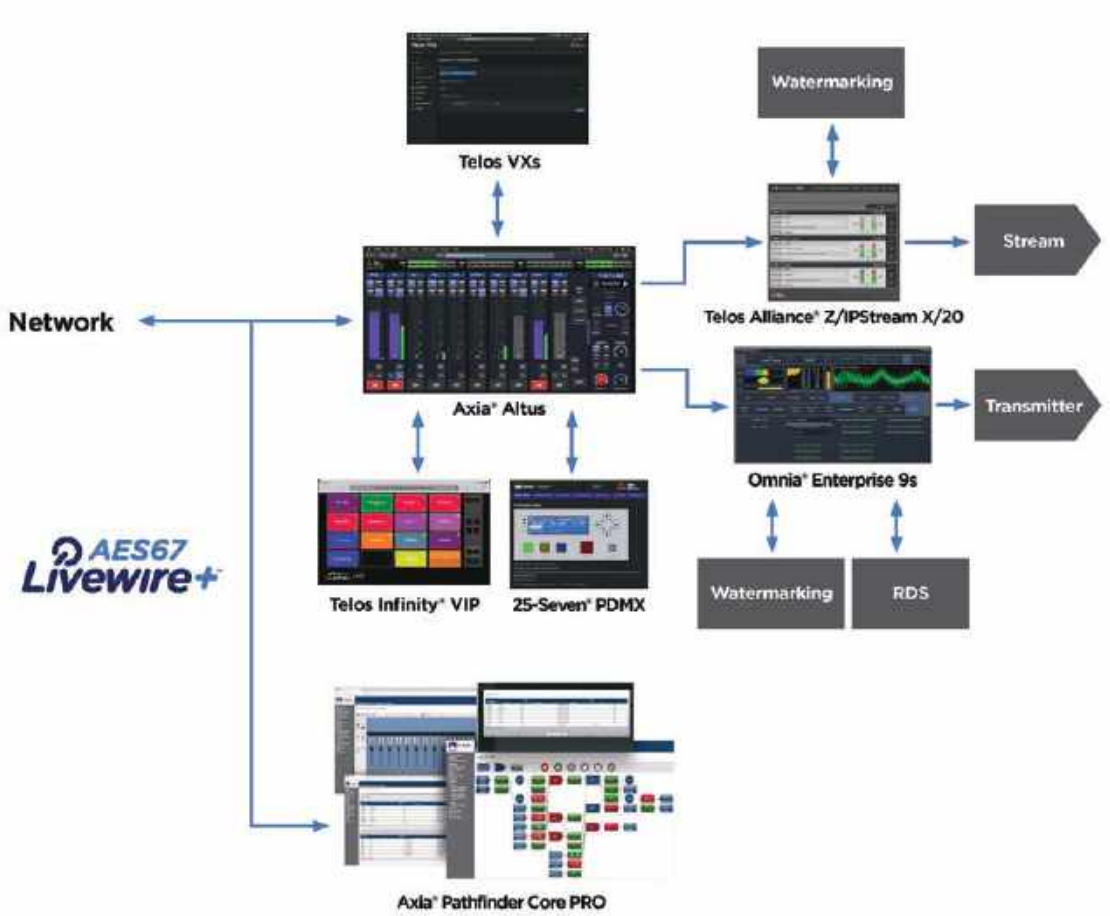
Op-ex vs. Cap-ex. Virtual solutions are often available as subscription-based services, which means they typically fall under operational budgets, while hardware is usually a capital expense. This gives customers ultimate flexibility in choosing how to fund their projects. Op-ex is very attractive for short-term projects and prevents facilities from going unused due to overbuilding.

Reduced overhead. Cloud-based virtualization requires less maintenance, real estate, conditioned power, HVAC and other costs associated with having hardware on-site.

Access to skilled labor. Virtualization leverages the skills of newcomers to the workforce with IT-centric experience and training.

Telos Alliance has been, and continues to be, a pioneer in virtualization for broadcasters. While we pride ourselves on innovating, our partners are driving us. Key customers have propelled us forward with engineering challenges, economic commitments and key insights that have

The Software-Based Air Chain



Left
Visualizing the virtual air chain.

aligned with our own experiences and lessons from other industries.

No one can predict the future, but we see the bets we've made on virtualizing our hardware products paying off amidst the general acceleration toward software and integrated, IP-based solutions.

In summary, we see multiple factors driving virtualization in broadcast:

- Cost efficiency and the trend toward reducing capital investment and centralizing operations.
- The enduring social changes brought to us by the pandemic (including remote work) and the acceptance that things will never go back to the way they were.
- The evolution of both producer and consumer and the broadening definition of what it means to "broadcast."
- The graying of the traditional engineering workforce and increasing pressure on studio maintenance costs, contrasted with the shifting skillsets of younger, "digital-native" workers with strong IT competencies.
- Continued supply chain pressures on component availability and lifespan, and shifts of silicon producers to more profitable and highly integrated SOC models.

Our current portfolio of virtual products addresses key pieces of a virtual air chain, from audio acquisition and mixing to telephony, audio processing, watermarking, STL transmission, and more.

For the record, our current lineup of virtual solutions includes Telos VXs Virtual VoIP broadcast telephone system; Omnia Forza HDS & Forza FM audio processing; Omnia Enterprise 9s high-density audio processor; Axia Altus virtual mixing console; Axia Pathfinder Core PRO VM broadcast controller; Telos Infinity VIP Virtual Intercom Platform; Telos Alliance Z/IPStream X/20 Streaming Encoder and Processor; and 25-Seven PDMX Virtual Program Delay.

These market-facing virtual products rest on common software tooling, ensuring interoperability with things like clocking, IO standardization and security. This underlying tooling can best be described as internal facing products that our various product teams are all able to utilize to further push virtual initiatives.

As we expand our virtual offerings, we are mindful both of the pieces we still need to build, and of the areas of expertise that are better left to other practitioners. While our offerings at Telos Alliance are broad, no single company can do everything.

A particularly gratifying collaboration is our recent effort with Digital Alert Systems and Nautel. Our EAS at the Edge initiative is a first step to facilitate virtual workflows by bringing EAS into the connected AoIP age. EAS has long been seen as a missing puzzle piece in realizing a purely virtual air chain. Given its special regulatory requirements, the hybrid solution we have helped introduce demonstrates what can happen when industry peers with a shared vision work together toward a common, "virtual" goal.

PPM finds its way into audio processing

Thanks to software, Nielsen's encoding algorithm no longer requires a separate box

Nielsen's Audio Software Encoder decouples the company's PPM encoding algorithm from the hardware encoder and instead makes it available for integration into third-party broadcasting equipment. When the software is incorporated into a station's audio processing, it can add the enhanced CBET code to the audio stream.

Nick Mannion is director of product management at Nielsen; he has responsibility for its audio measurement portfolio including the Portable People Meter and diary collection systems.

Above
Nick Mannion

What is Nielsen's interest in the software-based air chain?

Nick Mannion: First some background. Every station included in PPM measurement gets an encoder that places a watermark in the audio played over the air. Then we recruit a representative sample of panelists who carry around PPM, like the one I'm wearing here on my wrist. It picks up the code, logs it and sends the data back to Nielsen, where it's tabulated and then projected back out to the population.

Typically, watermarking at the broadcast facility has been done by a piece of hardware that Nielsen — and Arbitron before it — provided to the stations. But working with the NAB Radio Technology Committee and its PPM subcommittee, led by Jason Ornellas of Bonneville, we developed a software encoder that takes the brain out of the hardware and makes it available in a software development kit for any vendor to integrate into their product.

At Nielsen, we're agnostic on the question of virtualization. Our goal is to measure everybody in PPM markets equally, whether they are virtualized or condense their hardware onto an on-prem server. We need to make sure we're providing solutions so that they can be measured with that PPM watermark.

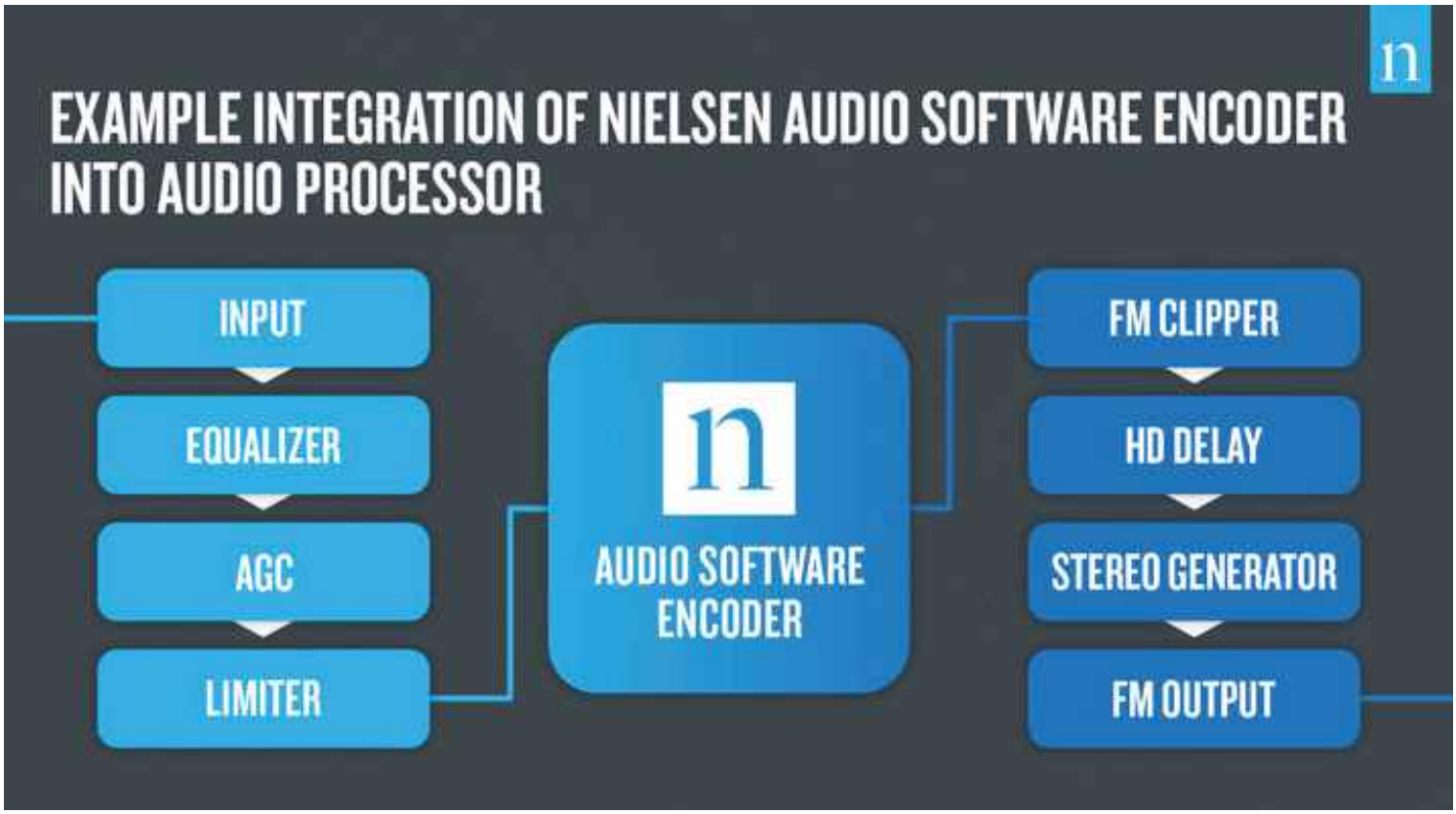
The software kit is available to any technology company that wants to integrate it in their product?

Mannion: Essentially yes, with a little bit of paperwork and NDAs. We now have 18 certified integrations including Orban, Omnia and Wheatstone. We have focused on audio processors because PPM typically sits in an air chain near the audio processor. On our engineering portal, stations can see which products are certified for Nielsen PPM encoding.

How does one get certified?

Mannion: A company requests our SDK to integrate into their platform. Nielsen's engineers work with them to understand what their product does. Then we develop extensive test criteria to make sure the PPM encoding coming out of the product is equivalent to what would come out of a hardware encoder, so that no station has an advantage or disadvantage. We develop a technical requirements document and hundreds of test cases — different ways you can set it up — and we make sure that you can't, for instance, inadvertently route around the PPM encoding.

Only then do we give them a certification, a license to distribute the Nielsen Audio Software Encoder to radio stations.



What are the most common concerns you hear from stations?

Mannion: This is something new, so when it comes to PPM encoding, which is critical for a station's revenue, some groups or engineers are more hesitant to change than others.

Many prefer to start on their station streams. We measure streams separately from the AM and FM; and we see broadcasters getting comfortable with the software encoder by dipping their toes in first using their streams, before they jump to their big AMs and FMs.

Was it technically difficult to assure that the software iterations were as reliable as the hardware?

Mannion: Not really. We run a battery of tests anytime we make a change in PPM or encoding. At our office in Columbia, Md., we have a critical listening room where we run exhaustive tests across all types of formats, content, processing volumes, background noise, etc.

We make sure the SDK puts out a good robust watermark, then we go through that certification process, looking at an individual product's integration, including the battery of more than 100 test cases.

After our initial rollout, we also conducted field tests on AM, FM, HD and streams. That data is shared openly with the Media Ratings Council as part of our audit requirements.

Last but not least we have a multi-channel encoding monitor that allows stations to look at the performance of their watermark minute by minute across their day, so they can see they're getting the same level of performance.

It's in our best interest as well as the client's to make sure they have a robust watermark.

> **"We see broadcasters getting comfortable with the software encoder by dipping their toes in first using their streams, before they jump to their big AMs and FMs."**

How many stations have switched?
Mannion: Around 500 streams in PPM markets have made the switch. Fewer so far on AMs and FMs. As I said, some are kicking the tires right now. But from my time spent at the NAB Show and meeting with various engineering leaders, as they look to virtualize their playout, this is where they are going. There are early adopters, and I think we'll have a lot of fast followers who are just waiting and see how the early adopters fare before they jump in. That's true not just in PPM but virtualization as a whole.

What is the potential universe of users? If you put one encoder on every AM signal, every FM signal and every HD multicast, plus every stream version of those signals, that must be 25,000 or 30,000 potential encoder points in the United States.
Mannion: Keep in mind that we measure with PPM in the top 48 markets. At the peak of the hardware encoder, we had about 13,000 pieces of hardware out at stations. Some stations have primary and backup encoders; some have a "doomsday path" to air, for emergencies. But as to the size of the potential universe, I'd say it is around 5,000 stations or streams.

Anything else we should know?
Mannion: The readers of Radio World, particularly readers of this ebook, are the people who are thinking about virtualization and cloud. What I'd like them to know is that Nielsen has options for them today, and that we're a willing partner to work with them on the future.

Below
Nielsen publishes a list of certified vendors for its Audio Software Encoder. You can view this chart and related information by clicking the image.

Nielsen Radio Certified Vendors

OEM Vendor	Product	Product Version	AM	FM	HD	Internet Streaming	Domestic	International	Radio Encoding
ATC Labs	Perceptual SoundMax	2.12			✔	✔	✔	✔	1.1.7
iHeartRadio	Sound+ EdgePlayer	1	✔	✔			✔		1.1.7
Orban	5500i	4.0		✔			✔	✔	1.1.7
Orban	5700i	3.0		✔	✔		✔	✔	1.1.7
Orban	8600si	3.0.0.1		✔	✔		✔	✔	1.1.7
Orban	PCn1600	2.0			✔	✔	✔	✔	1.1.7
Orban	XPN	2.0	✔		✔		✔	✔	1.0.7
RCS Sound Software	SoundCenter	v0.0.1	✔	✔	✔		✔	✔	1.1.7
Telos/Omnia	Omnia 9	3.30.79	✔	✔	✔	✔	✔	✔	1.1.7
Telos/Omnia	Omnia 9s	3.30.61		✔	✔		✔	✔	1.1.7
Telos/Omnia	ZIP/stream X/20	2.1.3			✔	✔	✔	✔	1.1.7
Telos/Omnia	ZIP/stream R/20	2.1.4			✔	✔	✔	✔	1.1.7
Thimeo	Stereo Tool- Enterprise	10.0	✔	✔	✔	✔	✔	✔	1.1.7
Thimeo	STXtreme (Hardware Processor)	10.1	✔	✔	✔	✔	✔	✔	1.1.7
Wheatstone	Layers Stream Core	1.0.1.0				✔	✔	✔	1.1.7
Wheatstone	Streamblade	1.0.2				✔	✔	✔	1.1.7
Wheatstone	Wheatstream	1.0.2				✔	✔	✔	1.1.7
Wheatstone	X5	1.3.0		✔	✔		✔	✔	1.1.5

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Why the software approach matters in HD Radio

Xperi seeks to reduce complexity, lower costs and facilitate software upgrades

Much of the conversation about software-based air chains has been around HD Radio. For insights we asked Joe D'Angelo, senior vice president of broadcast radio and digital audio for HD Radio's parent company Xperi, and Jeff Detweiler, its executive director of broadcast business development.

What does the phrase "software-based air chain" mean at Xperi?

Joe D'Angelo: Go back to the early days of HD Radio for a moment. If a station wanted to deploy HD Radio, there were two or three hardware boxes, computers to be installed at the studio or the transmitter, which all had to be networked. And that was just to create the digital waveform and inject encoded audio for HD Radio.

It was expensive and complex. The devices would age out, and you had issues with maintainability of components. We'd do a software implementation on a chipset and three years later it wasn't available, so replacement parts were a real challenge.

We started to look at how could we take components of the HD Radio system and move those into the cloud, to reduce complexity and dependence on customer-premise

Below
Joe D'Angelo

hardware. It wasn't easy. It's a real-time system and not very forgiving of processing delays and network hiccups.

But the industry has gotten more comfortable with core components of their infrastructure operating in a cloud environment. From our perspective, RCS really led the charge in taking Zetta, a critical piece of studio equipment, and decoupling it from hardware. We thought that if they can do it, we should be able to do it.

There's been a concerted effort underway at Xperi for about five years to take the pieces of the HD Radio system and move them into a cloud-based architecture.

Not only does this reduce hardware dependency but it provides the ability to perform software upgrades in the cloud, which is extremely valuable.

We're also doing this with our Rapid metadata platform, which works across analog, HD Radio and DAB. There's a cloud version that decouples metadata functions from hardware and puts it alongside other cloud-based systems.

Jeff, what process has been required for Xperi to move parts of the HD Radio air chain from hardware to virtualized components? And what factors have driven that migration?

Jeff Detweiler: Fortunately, our decisions over the past several years to create common libraries made transitioning to containerized virtual systems much easier for our manufacturing partners.

As to factors, the pandemic accelerated the development of virtualized broadcast environments. IT managers have often become broadcast engineers, and along with that evolution, they desire to host virtualized systems locally and in cloud services like their IT infrastructure. Moreover, broadcasters are shifting from cap-ex to op-ex for broadcast and IT infrastructure. The small and medium broadcasters need virtualized and low-cost hardware solutions to make the technology practical.

What were the hurdles that had to be overcome?

Detweiler: The greatest challenge in a virtualized HD Radio environment is synchronizing the analog and digital paths. Two transport standards are underway to define protocols for encapsulating the HD Radio E2X stream and MPX audio. The IBOC Standards Development Working Group of the National Radio Systems Committee is in the process of defining an analog and HD Radio interoperable transport layer that all manufacturers can build toward. The IEEE Broadcast Technology Standards Committee is defining the Aggregated Content Delivery Link or ACDL, which will work for all radio broadcast technologies worldwide.

Standardizing this interface holds the promise of manufacturer interoperability and consistent system performance. Xperi and its manufacturing partners are actively participating in this work.

Below
Jeff Detweiler

What process has Xperi followed to collaborate with manufacturers to get to the current point?

Detweiler: We deliver core software elements that manufacturers use to create innovative and differentiated product solutions. Our philosophy is simple: Enable the manufacturers to revolutionize the technology.

In this context, Joe, why is what Nautel doing notable?

D'Angelo: Nautel has been a great partner and innovator around the HD Radio system, constantly looking for ways to simplify the network architecture of HD Radio components, whether it was the importer, the exciter or the Exgine. They've really pushed us to identify components that could be extracted from hardware dependency and migrated to the cloud. They've focused on cost reduction and innovation to increase consistency and reliability, while driving costs and complexity down.

Is there still a lot of room to streamline and simplify the HD technology infrastructure?

D'Angelo: I never want to say innovation has run its course. But we've come a heck of a long way from the early days of HD Radio, when the initial broadcast equipment was seven Sharc cards, each of which cost thousands of dollars. Now we're running on a combination of cloud services and off-the-shelf DSPs.

Reliability was always good; the system has a very strong runtime percentage. But innovation has been focused on reducing complexity and costs.

Now we're trying to do more with less — in EAS, in integrating new DTS AutoStage functionality and in improving audio quality, especially for AM. We've expanding our metadata portfolio and enhanced the Program Service Data to include release dates of albums and IDs. We are involved in some other projects on the hybrid radio side that we hope to be able to talk about publicly soon.

But moving into software- and cloud-based designs is enabling more innovation, and helping broadcasters deploy HD Radio more quickly than is possible with a hardware-dependent solution.

So I think we've come miles and miles in reducing the cost and complexity of our part of the HD Radio chain. Today we see Nautel putting cards inside of transmitters that replace entire network computers and getting new features out of the available bandwidth. That trend will continue.

Jeff, what should we know about developments such as integration of EAS or other functionality?

Detweiler: The Emergency Alerts System is prime for modernization. HD Radio and RDS increase the availability of EAS text messages beyond audio. However, as broadcast virtualization evolves, the FCC will likely need to consider how the type-approved alert hardware solution fits into that model and, where appropriate, can it be virtualized. Virtualization offers several advantages concerning redundancy and self-healing systems. The existing hardware requirements around the presidential alert are the biggest roadblock to that virtualization.

I have a perception that the uptake of FM HD Radio by stations essentially has plateaued. So Joe when you talk about the benefits of software-based air chain, is it mostly to benefit existing users through simplification and cost savings? Or do you feel these changes are enough to move the adoption needle?

D'Angelo: It's both. We actually average about 80 to 100 new stations a year in North America. Among the early adopters, a company like iHeart is probably on its third generation of HD Radio, and Jeff Littlejohn in particular has been instrumental in pushing for a cloud-based architecture and driving innovation and cost-reduction.

Canada came later to the HD Radio conversation after its efforts with DAB, and now broadcasters there are adopting HD Radio. They get the benefit of 20 years of engineering innovation and a lower-cost solution.

Today it's much easier, especially in resource-constrained times, for a station to deploy HD Radio.

Some in the industry industry have a perception that HD Radio is stalled, yet we have 105 million cars on the road. The technology is more affordable than ever, and it's easier than ever to deploy it.

Now as an industry we need to drive action within small and medium markets to embrace this. It's important that we continue to educate people about how easy it is to add HD Radio to your broadcast stream.

What else should radio engineers know?

Detweiler: When dealing with a technology that aspires to five-nines of availability (99.999%), we need a low-cost hardware-centric solutions offering a complete backup (Importer/Exporter/Exgine) at the transmitter site. That's where a Raspberry Pi HD Radio hardware solution with USB audio interfaces, fed locally with audio, will play an important role in backing up cloud systems.

> **"There's been a concerted effort underway at Xperi for about five years to take the pieces of the HD Radio system and move them into a cloud-based architecture."**

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RCS offers the power of an integrated approach

Our ecosystem helps you meet the challenges of multi-platform audio delivery in the modern era

Writer

Philippe Generali
President/CEO
RCS

The RCS ecosystem was designed to solve content creation and delivery challenges facing broadcasters in the modern era — from leveraging a distributed workforce to providing unique cloud solutions.

RCS has made this ecosystem powerful enough to scale to meet the complexity of big groups while remaining nimble enough to assist the smallest broadcasters trying to build efficiency and focus. RCS gives your talent their time back — to really focus on what is live and local — talking about local sports and weather and doing live reads — the things that make the community part of the broadcast.

Built from the ground up

This ecosystem has been designed to work together. Its software components interlock, and data flows between them, increasing accuracy and saving time.

This is a big deal if you've got hundreds of stations, but it makes a difference even if you're a standalone station programming multiple HD subchannels or streams.

Imagine you're a PD or MD and you're working on your log, putting in an Ed Sheeran record next to a Harry Styles next to a Lady Gaga. How much time do you want to spend getting that transition just perfect for every station? Could you spend those 25 minutes instead working on your podcast or a best-of for the morning show?

We take tedious tasks and apply a focus on time efficiency so that you can improve your overall audio products.

Consider the RCS GSelector S3 Scheduling Engine and how it interfaces with automation playout system Zetta.

We have an RCS user whose application provides a useful case study. They have created a "master log" to which their affiliates can subscribe. Affiliates include stations in other markets playing the same format, but it can also be an HD subchannel playing a different version of the "master log" of the main channel. This could involve two "stations," or dozens.

In this example the user assigns a format champion to schedule the "master" log, which essentially is the basic idea of the format they've created. But the ideas evolve from there. They apply their best research and placement methodologies to achieve the best master log they can. Then S3 allows them to deploy various versions of it rapidly and according to rules they set up, tweaking songs according to the needs of their local markets and inserting custom imaging and different voice tracks if desired.

In the old days you'd only have a log for a single station. When you apply those rules between S3 and Zetta, you may have a dozen stations programmed according to that core ethos yet customized to meet the needs of each market or channel.

Working from anywhere

When you pair those capabilities with remote contribution module Zetta2GO and Multisite Voice Tracking (MVT), talent is able to create voice tracks that present differently for each station.

You still want core tracks that are heard across every station carrying that master log, interspersed with imaging and liners that are custom to each individual affiliate station. But now those "national tracks" can be combined quickly with "local tracks" that speak to each community or target audience. Your program directors, music schedulers and air talent are able to multiply their efforts across stations many times over.

One RCS customer had four stations in one market. Adding a song took 10 minutes a week. Then they added a second market. It was still the same task but it required no added time. When a third market came online, the same applied. What once would have required 30 to 60 minutes to add a single song across multiple stations playing a similar format, now takes one person 10 minutes.

The ecosystem approach translates to efficiency and accuracy throughout your workflow.

Need to add a new song? Where does it go? In many competing platforms, you'd need to key that information into the scheduling system and again into the automation, where you're also adding the media. With Zetta and GSelector S3, you add the song once and the metadata associated with it is available instantly across the ecosystem. Start typing the name of a song that's been entered somewhere in the system, and the name appears instantly — in its complete, accurate form — in any module you are working in.

The power to do more

While many broadcast systems use middleware to push and pull content to and from different places, RCS products were designed to work together. Key processes are all done within the software, and services are communicating underneath with other software in the ecosystem. There's

nothing outside. No extra server to add or maintain.

We're doing album art with Xperi, for example. Once you plug it into GSelector, that album art and its related content are now plugged in as well, all part of a universal ecosystem whether you're using the primary Zetta software or even the 2GO mobile software.

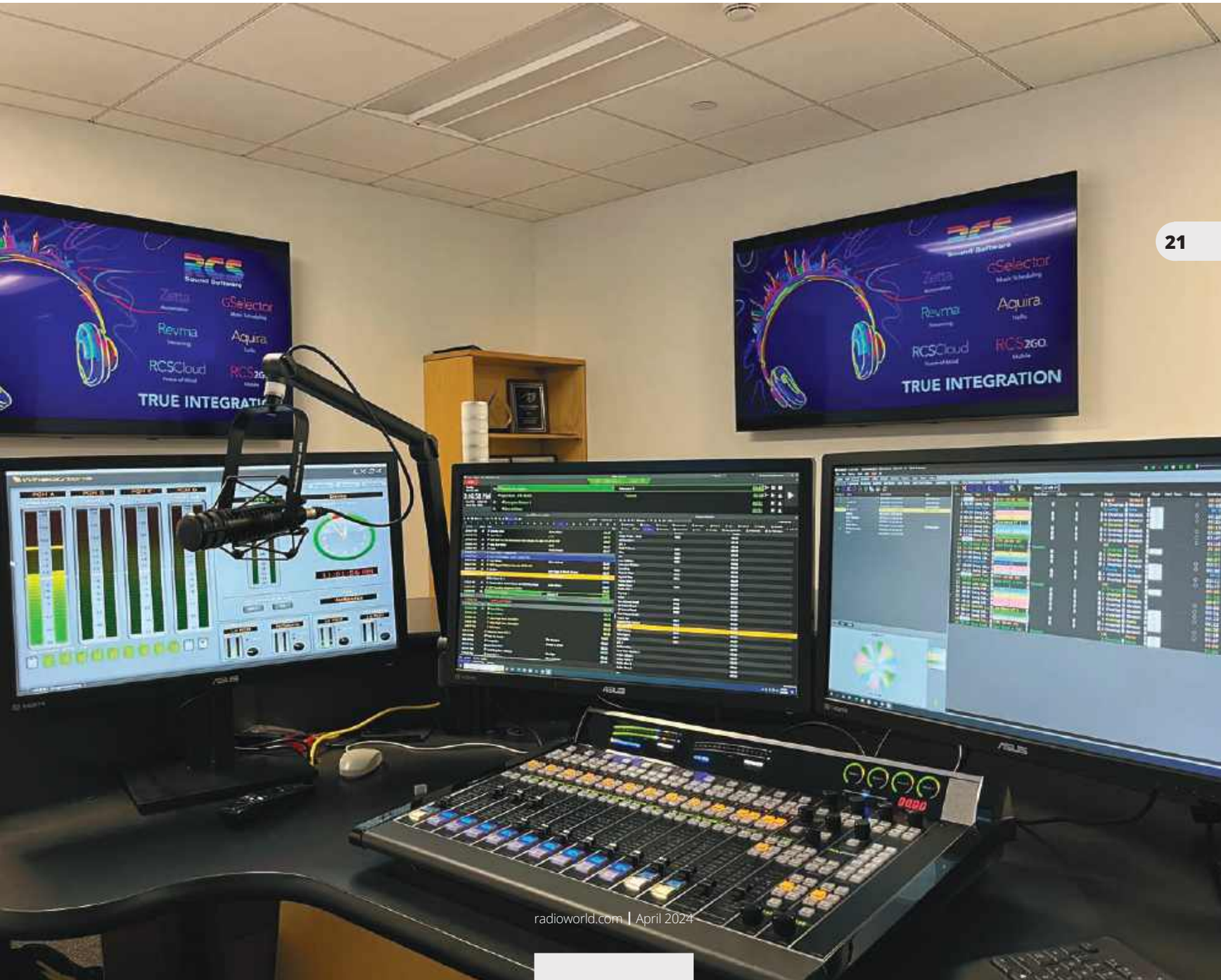
The more complicated and custom an ecosystem, the more likely humans are to make mistakes. When you need to keep track of special attributes — a particular song must never air in a certain market, or a particular talent should never be heard on a given stream due to union restrictions — it can be challenging to keep the rules straight.

The RCS ecosystem is designed to handle this. Metadata sticks with every component and drives the desired outcomes. You can enter a custom attribute in GSelector or Zetta along with your audio, and the attribute follows throughout the system.

Similarly, we provide tools to avoid mismatches that can happen when you have multiple people in your workflow. An RCS user recently told us that one person on their team types "Doctor Dre" while another types it as "Dr. Dre." With the integration across Zetta and GSelector, this user doesn't have to worry. We ensure that their data is clean across the board, preventing chains of errors that would have needed someone's time and attention to correct.

On-ramp to the cloud

We're building a cloud-based service to support dramatic increases in scale. We're not just taking old software and virtualizing or containerizing it. We're building it from



scratch using the most flexible and modern sources.

Our most widely deployed cloud offering is Zetta Cloud, which bridges the traditional on-premises Zetta playout system and the future-looking cloud-based iteration of Zetta. It provides secure, redundant, resilient full-time playout in the cloud. It syncs logs and content from GSelector and the rest of the RCS ecosystem and is ready to deliver your content direct to your transmitter or streams at any time.

We're giving broadcasters the chance to preview what it's like to operate in the cloud while delivering the on-premises solutions that many broadcasters are still most comfortable with.

This approach enables broadcasters to "try it on for size" and enjoy serious, immediate disaster recovery benefits at a low cost of entry. Meanwhile you're trying out the cloud as an operating system — all of your content, your metadata, your users are being refreshed in real time. We look at this as providing broadcasters an on-ramp to a new way of working.

Secure and scalable

For broadcast engineers, enterprise-level IT can be intimidating and often left for "corporate IT" to manage. For corporate IT folks, considering all the aspects of 24/7 content delivery and balancing tradeoffs between security and usability can be challenging.

RCS best-in-class security solutions expand to our cloud offerings. We support two-factor authentication, domain-level management and logins, integration with Active Directory and granular user rights administration, across all components of the RCS ecosystem. Whether you are thinking about how best to manage security for staff working on-premises at a studio complex or others handling music scheduling or on-air talent voice tracking half a world away, the security offerings of RCS will deliver both usability and best-in-class protection.

And in the event that a local on-prem system is compromised, RCS cloud offerings stand ready to provide disaster recovery at a moment's notice.

Integration means better metadata

Another consideration increasingly takes center stage: the role of metadata in describing your content.

Given the number of systems at a single station that manage main channel content, HD subchannel content, stream content and special channel content such as holiday-themed streams, it can feel nearly impossible to keep up with the web of data necessary to describe it all.

Yet as vehicles evolve and consumers increasingly expect the same rich media experience from all sources, it has never been more critical to have accurate metadata, including album art. RCS is well positioned to help broadcasters look their best in the dash and offer additional engagement (and revenue) opportunities.

Our AudioDisplay platform enables your organization to deliver a top-notch dashboard experience across FM, HD and hybrid radio and explore new revenue streams. It offers granular management of text and image advertising content delivered in-sync with your audio.

Just as artist album art travels in-sync with songs throughout the RCS environment, now stations can add graphical advertising content to spots and deliver them to consumers in a compelling way in the dashboard. AudioDisplay allows you to create these ads as well as manage and schedule them. It is a companion to RCS scheduling platforms GSelector and Aquira.

By leveraging the power of RCS Cloud Connect, they are all able to integrate these graphical components with the sales, insertion and billing processes. While it integrates with Zetta, RCS AudioDisplay also works with automation systems from other companies. Just as other RCS products strive to ensure the data is accurate from the point of entry, AudioDisplay contains safeguards to ensure proper image sizing/formatting and accurate campaign data.

Whether you are a small-to-mid sized broadcaster trying to work more efficiently in order to free up staff time to focus on podcasting or outside events, or a larger broadcaster looking to apply your research-driven best music practices or enable talent to work nationally and still connect with local audiences in the most compelling way possible, the RCS ecosystem stands ready to help you meet the challenges of multi-platform audio delivery in the modern era.

> **"RCS has made our ecosystem powerful enough to scale to meet the complexity of big groups while remaining nimble enough to assist the smallest broadcasters trying to build efficiency and focus."**

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Welcome to "EAS at the Edge"

Modernizing broadcast radio EAS through hybrid virtualization

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Virtualization is seen as a path to help reduce infrastructure, maintenance costs and system complexity. The technology opens new possibilities that may provide cost savings and new functionalities, but virtualization has its limits. Not every application is well suited to be run on a virtual machine. This can particularly be the case where there is a complex matrix of regulatory, security and operational considerations with which to contend.

The Emergency Alert System (EAS) is just such an environment.

In this article, we present the solution to integrating EAS operations into the modern virtual environment while both maintaining the integrity of EAS message delivery and adhering to the range of FCC regulatory requirements.

EAS at the Edge represents an architectural approach supporting virtualization, which involves distributing tasks between advanced EAS edge devices, virtualized applications and centralized cloud servers. Dedicated edge appliances in this virtualized architecture serve as specialized hardware platforms designed specifically for the required emergency alerting tasks while seamlessly interfacing with both the virtualized broadcast system and supporting other cloud-based services.

Overall, dedicated EAS edge appliances will continue to play a critical role in enabling the deployment of virtualized workloads at the edge.

Hybrid virtualization of EAS

A core concept in EAS at the Edge is hybrid virtualization. Hybrid virtualization entails leveraging edge DASDEC appliances while virtualizing the management, maintenance and monitoring of those edge EAS appliances.

Hybrid virtualization combines elements of hardware and virtualization to accomplish the goal of simplifying messages that an EAS presents from reception to playback.

Key functions of the DASDEC in a hybrid virtual architecture are:

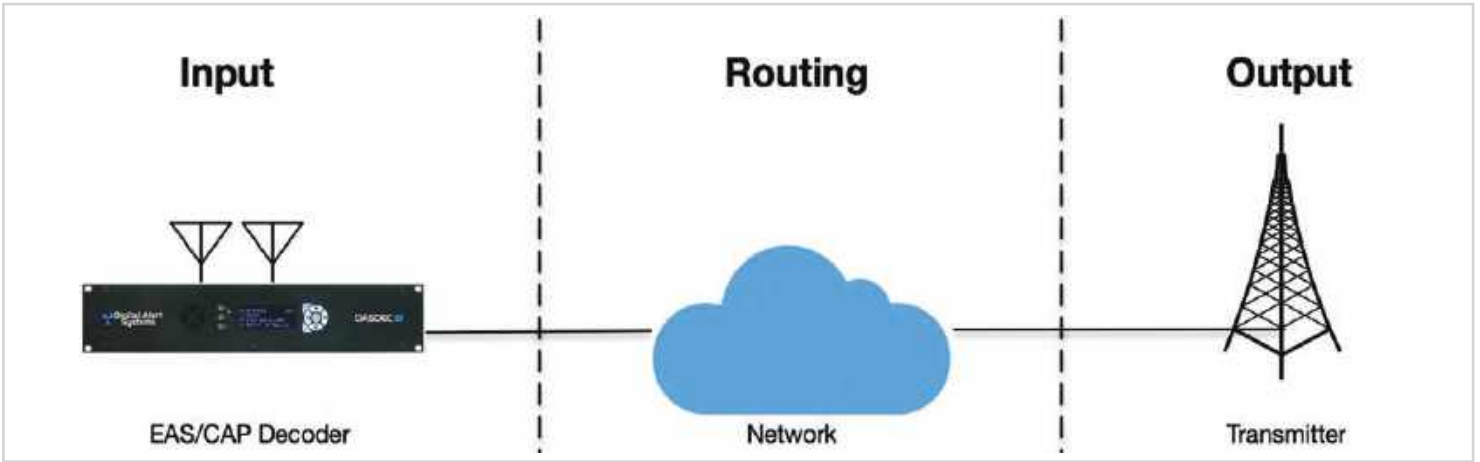
- Capturing the EAS transmissions directly from the OTA sources
- Using the decode logic to apply filtering algorithms and determine if anything needs to be forwarded
- Putting critical processing where it needs to be — decoding at the very point of reception
- Routing data to targeted endpoints for distribution

Placing critical signal processing elements at the edge of a network provides the best possible scenario. By leveraging the analog elements at the edge, the information is converted into digital form for subsequent playout.

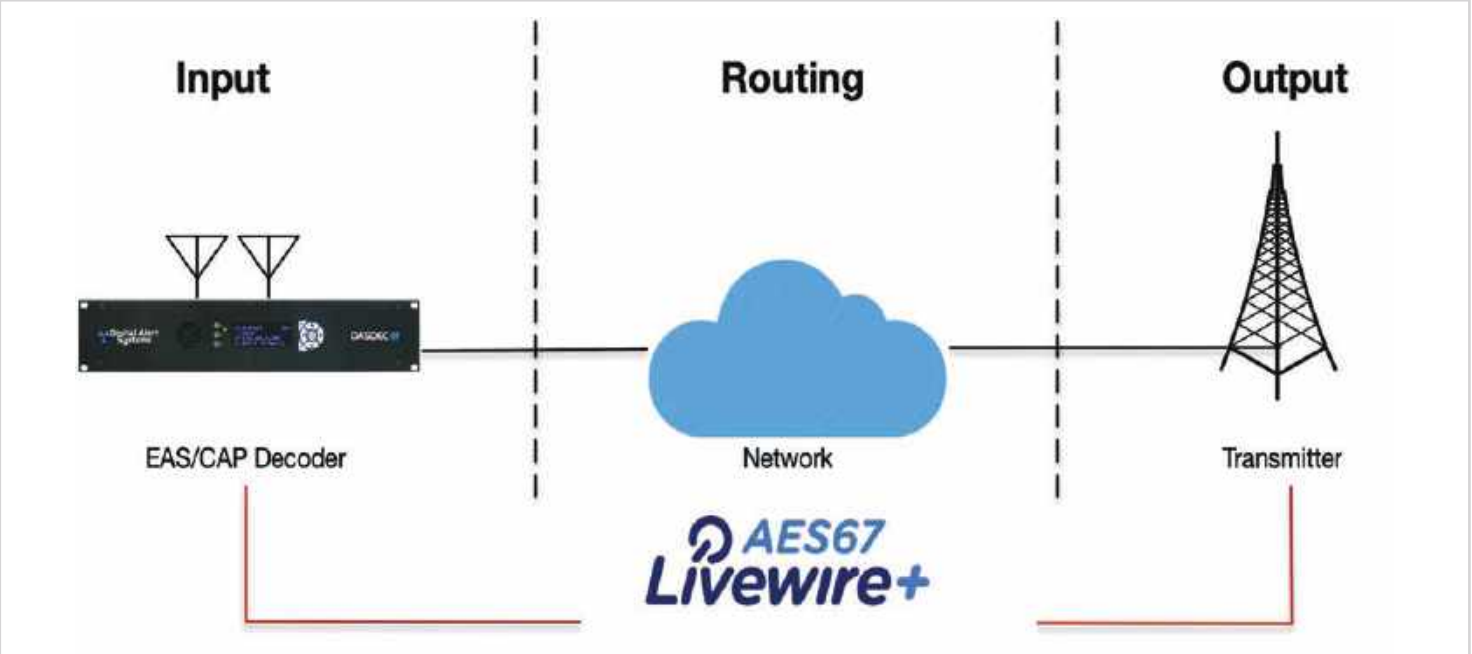
Linking the pieces

The hybrid virtualization places key, critical components — receivers and EAS decode logic in the DASDEC — at the edge of a network, and sends the information as IP data to the other edge of the network.

The diagram in Fig. 1 shows three primary elements of the overall network: Input, Routing and Output. The EAS message being processed (decoded) is at the input or one edge of the network. If the processing at the input determines a message should be forwarded, then it is packetized as data combining the AoIP and routing



Below
Fig. 1: EAS at the Edge is about hybrid virtualization. This image captures the simple concept.



Above
Fig. 2: Introduction of signal and routing protocols.

information for the intended target output. In this example, it is forwarded through the network to the transmitter output — the other "edge" of the network. By incorporating routing information with the audio message, a simple input to output, or edge-to-edge workflow is accomplished, and fulfills a number of benefits.

Input

The Digital Alert Systems hybrid approach ensures decoding is done at the earliest possible point, quickly converting the information into data that can be forwarded as IP data to downstream equipment.

This also means the filtering functions can be performed, and only necessary data is forwarded, saving network bandwidth or tasking other remote processes. Moreover, when information exchanged is IP data, alerts and information on alerts can be transmitted using a protocol that ensures data delivery. In other words, this control ensures that a data packet arrives intact at the desired location.

Quantizing the input radio signals into an audio stream and then linking that to another device to decode introduces many unnecessary and unwanted variables. Besides taking up bandwidth, regardless of whether there is an EAS message or not, the introduction of more devices, and perhaps remote devices, puts the entire system in jeopardy from the start. More connections equates to more opportunities for failure.

A tightly coupled appliance with integrated receivers can be more closely aware of signal integrity without network perturbations that could hinder proper message decoding. This ensures that the critical first step of analog-to-digital conversion remains as robust as possible. Once an EAS message is decoded and determined to be aired, the DASDEC creates an AES-67 output for insertion into the virtual air chain.

Both network "edges" may be at the same location — the transmitter site — causing additional redundancy; an external network failure, i.e., loss of internet connection, won't impact the ability to deliver critical alert messages. More on this is outlined below.

Routing

The reader should understand that simply sending digital audio to a digital air chain cannot guarantee that someone (talent) or something (automation) won't override the input by switching to another source. These issues rarely materialize in traditional EAS, as the encoder/decoder is typically the last switching element in the air chain. The alert playout cannot be overridden by another device, improper settings upstream, or signal rerouting.

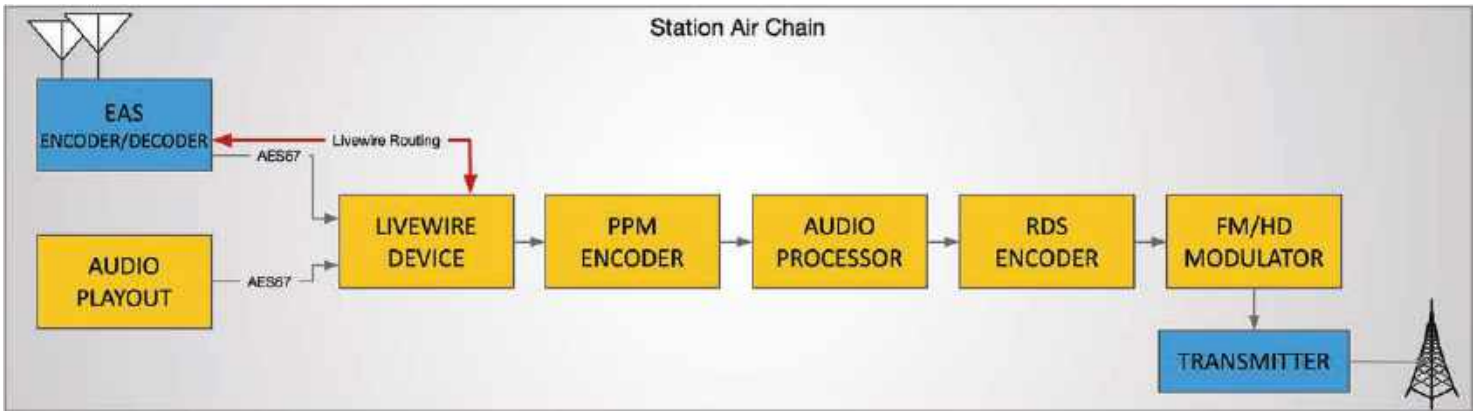
In the virtual world, we solve this by using the Livewire Routing Protocol to verify that our AoIP output is always routed to the output. By asserting the EAS signal at the output or other edge of the network, nothing else can get in the way or cause the EAS playout to switch away.

Our diagram from Fig. 1 now expands, offering more details on how we can move from one edge to the other using AES67 for audio transport and Livewire+ to control signal routing. This addition is shown in Fig. 2, indicating the signal flow from the input edge to the output edge.

Fig. 3 represents the elements within this modern air chain.

Other considerations

In normal operation, the station's air chain will likely include a Nielsen Portable People Meter encoder, producing a unique audio watermark at the output. However, if the



Above
Fig. 3: A block diagram of a radio station air chain. Items in blue are edge devices.

station receives an alert from an originating station with its signal PPM encoded, we must consider the impact if the receiving station tries to add its watermarking to the source audio. This is very important, as it is not recommended to cascade PPM encoding on the output signal as shown in Fig. 4.

To prevent cascaded or doubled PPM encoding, the EAS playout device can send a control signal to the PPM encoder to bypass operation while the EAS audio is being played. Simultaneously, the audio processor can switch to a more EAS-friendly template or preset, allowing it to better match the dual mono EAS voice playout. This ancillary control is depicted in the diagram of Fig. 5.

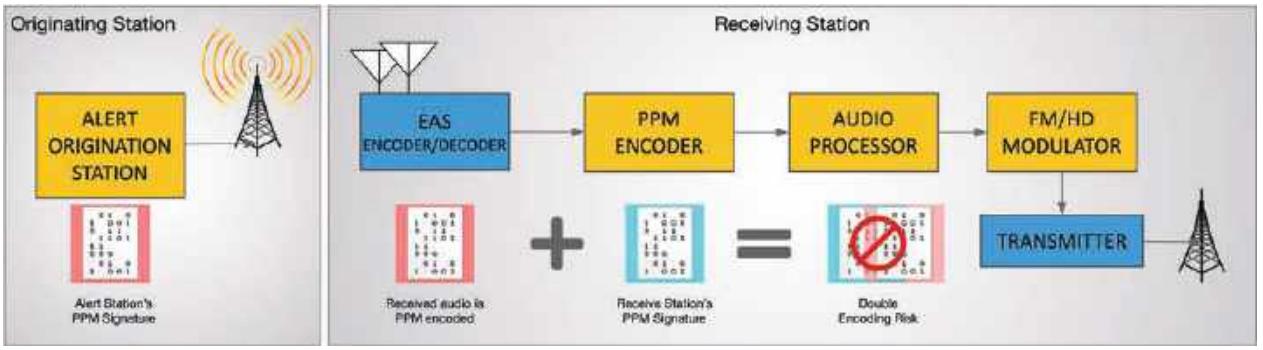
Other metadata

Besides getting the right audio to the right place, additional metadata for an alert could be leveraged within the air chain.

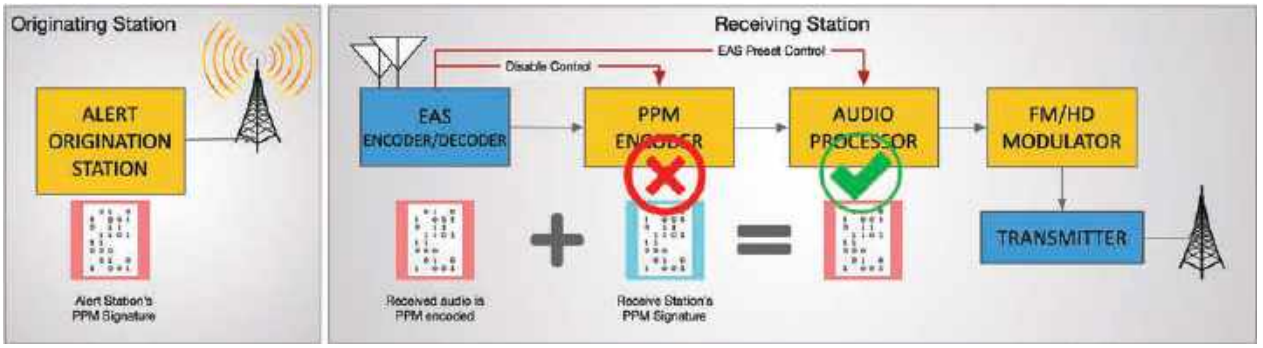
For example, the "alert translation" — EAS parlance for the text of a message — can be used to present the alert text into an FM radio's RDS system. This provides listeners with more information regarding the nature of the alert and potentially important details, for example, the license plate number of a child abductor could be displayed on a vehicle dashboard in the case of an AMBER alert. Other examples could be contact numbers, road closures and power outages that may impact a stationary or mobile listener.

Also, this information can remain "active" for the duration of the alert, meaning although the alert audio may play once, the RDS data could remain until the alert has passed or another alert supersedes it. Moreover, it allows a station to provide the text as an RDS element and a graphic to depict the specific type of event as a visually descriptive element of the particular alert and present it in place of the existing graphic.

To facilitate this information, the EAS at the Edge



Right
Fig. 4: EAS playout with originating and receiving PPM encoding. Livewire+ device and RDS encoder are removed for simplicity.



Right
Fig. 5: EAS playout with PPM disabled and processing preset invoked.

approach uses EAS-Net, a third IP data protocol designed by Digital Alert Systems to provide box-to-box communications regarding alert events. The EAS-Net data provides compatible devices with an extensive list of alert-centric information they can use in various ways.

After combining all the elements and expanding the block diagram, we have the layout shown in Fig. 6.

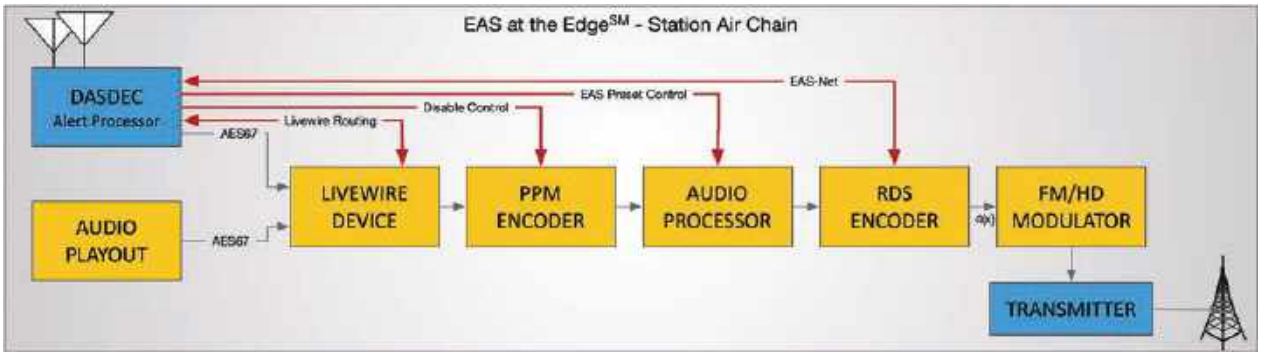
While the EAS at the Edge Station Air Chain in that image represents multiple boxes, these are processes along the path, not necessarily physical devices. In fact, many of these elements are software components that can be hosted on a platform well suited for their specific process requirements. For example, the Livewire Device, PPM Encoder, Audio Processor and RDS Encoder functions are all combined in the Omnia.9 from Telos Alliance, a single-box solution for all these pieces, as depicted in Fig. 7.

In further support of combining processing elements, the Nautel GV2 transmitter combines all the Omnia.9 elements — Livewire Device, the PPM Encoder, the Audio Processor — adding the FM/HD Modulator and Transmitter functions in one powerful package, immensely simplifying the overall system, as shown in Fig. 8.

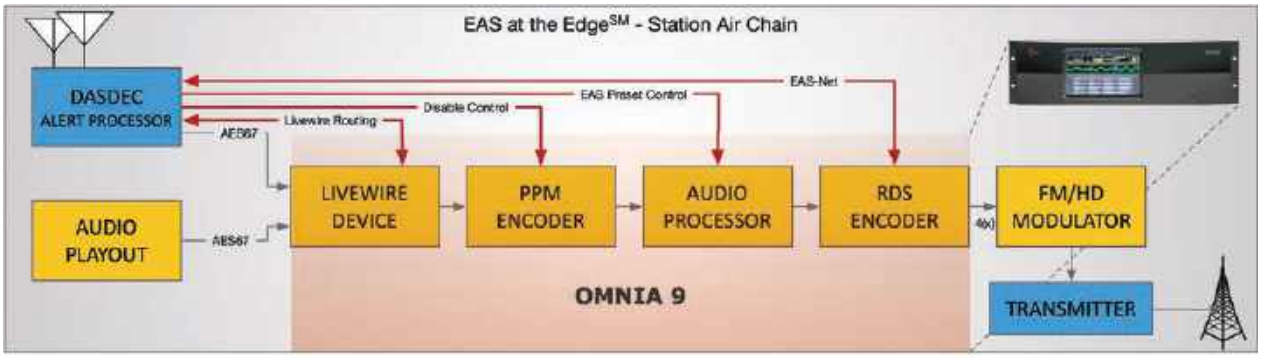
The additional benefit of the Nautel GV2 system is the simultaneous support for FM and all HD outputs. It can synchronize all HD outputs and keep everything time-aligned without more complex routing or a separate HD exciter. Additionally, the GV2 uses the EAS-Net metadata to select graphics for display on the consumer's receiver. This presents graphical elements associated with the specific event type, and two examples seen on a consumer HD receiver are shown in Fig. 9.

This level of integration across the entire radio ecosystem has never been fully realized until now.

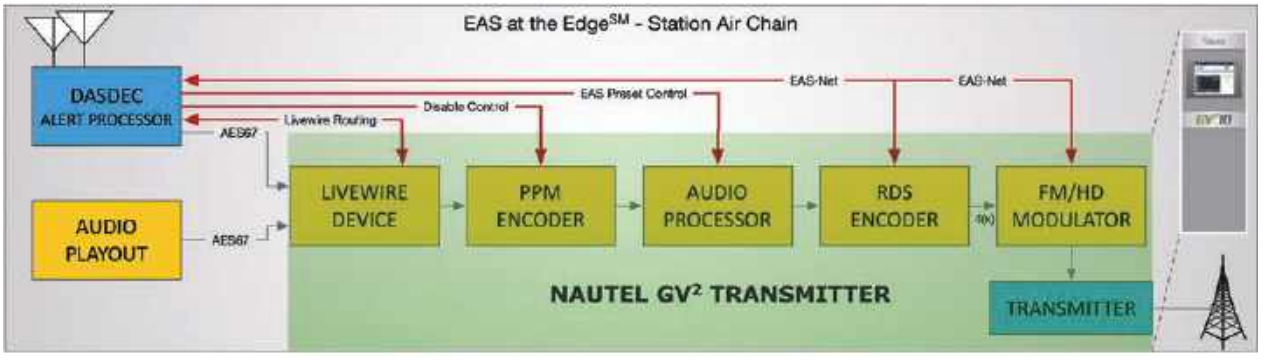
Returning to the simplified model introduced in Fig. 1, the concepts are more easily presented, with a Digital Alert Systems DASDEC on the network's input edge, the signal routing through the network, and ultimately to the Nautel transmitter on the output edge. See Fig. 10.



Left
Fig. 6: The elements of the EAS at the Edge air chain for EAS audio and control.



Left
Fig. 7: EAS at the Edge shows processing elements combined in an Omnia.9 system.



Left
Fig. 8: This image shows the chain with a Nautel GV2 transmitter, which contains many air chain elements in a single device.

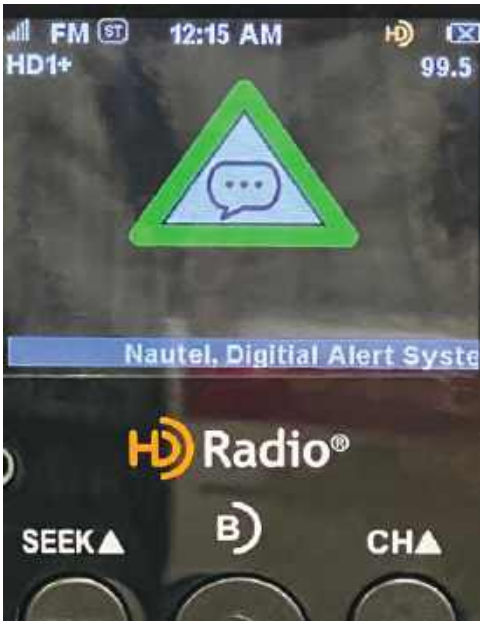
> **Hybrid virtualization combines elements of hardware and virtualization to accomplish the goal of simplifying messages that an EAS presents from reception to playback.**

Key benefits of EAS at the Edge

Highlighting the EAS at the Edge improves reliability in a hybrid-cloud architecture in several ways:

- Reduced Network Dependency: The DASDEC functions as an edge device, reducing network dependence for initial signal processing. This, in turn, reduces potential failure points, improving reliability and yielding faster system response times.
- Offline Capabilities: The DASDEC can operate without an internet connection or intermittent network connectivity as an edge device. Even when there is a temporary loss of connectivity to the internet or the customer network, the DASDEC will continue to function and perform critical monitoring and message-decoding tasks. This ensures that essential services remain available even when the network is unreliable or temporarily unavailable, again enhancing overall system reliability.
- Bandwidth optimization: By performing initial RF demodulation, FSK data decoding and data filtering/preprocessing at the edge, we can ensure only relevant data is shared in the virtual environment to optimize bandwidth usage by reducing the amount of data that needs to be transmitted through the network. By processing and filtering data at the edge, only relevant or aggregated alert and system data is sent through the network, reducing the amount of traffic and conserving overall data bandwidth. This improves network efficiency and reliability, especially in scenarios with limited bandwidth, high data volumes, or spotty availability in an emergency.
- Reduced latency: Any edge-to-cloud latency is removed by processing alerts and data in the edge device. The FCC timing parameters for the EAS FSK are not conducive to processing lags; therefore, sending demodulated RF as a stream or digitized audio to a remote decoding device is prone to possible decoding errors with the potential to miss critical alerts. Having the right tool in the right place is crucial for applications that require real-time or near-real-time responses.
- Offline capabilities: The DASDEC can continue functioning without a stable internet connection. It can process data locally and synchronize with the cloud when connectivity is restored. Moreover, if the edges are collocated or the network is in the same local LAN, the entire process can continue to work
- Enhanced privacy and compliance: Processing and storing sensitive data locally in the DASDEC at the edge reduces the need to transmit it elsewhere in the network, enhancing privacy and compliance. This includes compliance with FCC equipment and EAS operational requirements.

Below and Right
Fig. 9: Consumer HD Radio receivers showing alert graphics and text.



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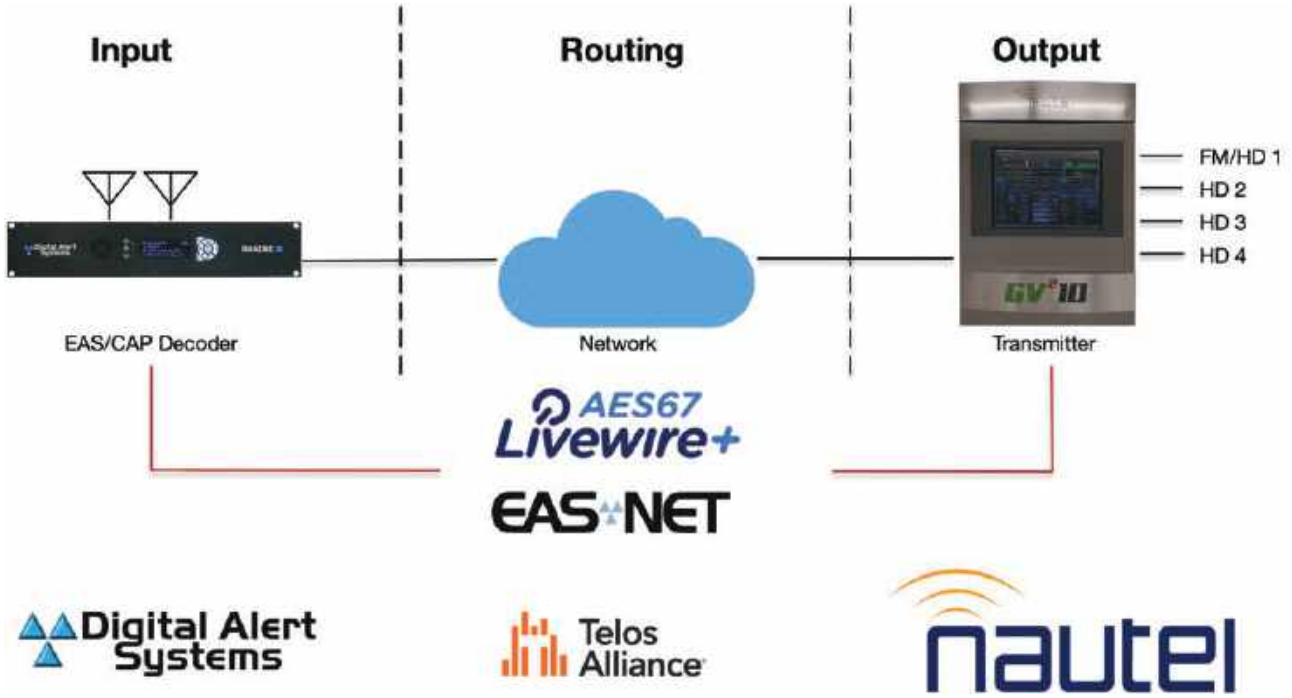


Extending the concept

Moving beyond a single site to many sites, the EAS at the Edge architecture allows virtualizing the monitoring and maintenance of these multiple edge DASDEC systems. Operating, managing or simply maintaining multiple EAS devices greatly benefits from virtualized management services by ensuring no operational compliance issue or potential loss of service.

The patented HALO system from Digital Alert Systems provides a virtualized EAS device management solution. As a virtualized service, HALO consistently monitors key elements from every site. HALO provides detailed information about individual EAS units with a comprehensive idea — the HealthBeat.

The HealthBeat presents a comprehensive view of the overall health of the EAS environment, giving users greater confidence that everything is properly functioning.

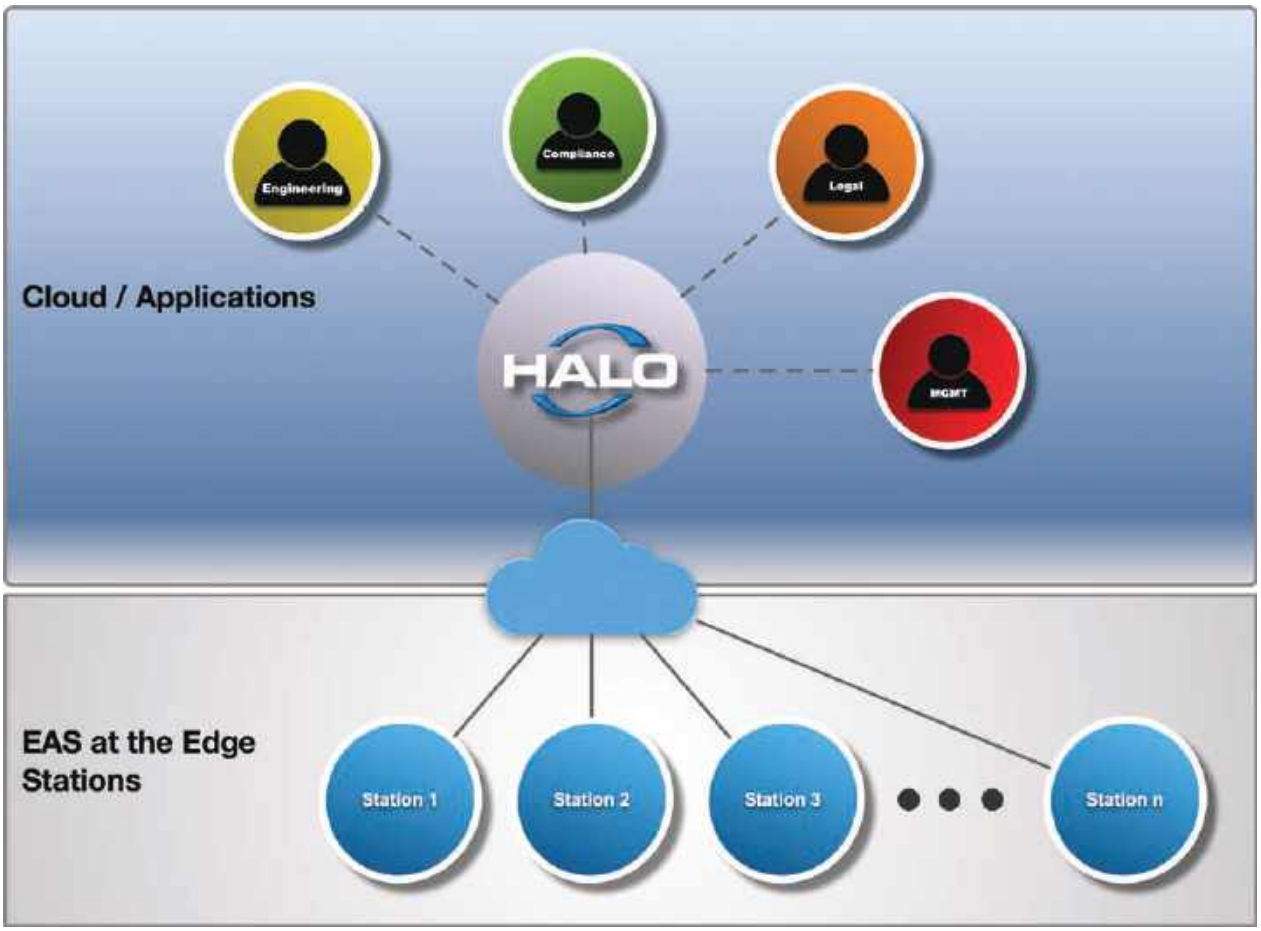
Centralizing EAS management with HALO means aggregating information, including the critical EAS logs, from all DASDEC edge units to streamline operations, leading to cost and resource savings. HALO provides critical support for edge EAS operations by assuring the latest configuration settings are stored and readily retrievable, streamlining initial setup or replacements, and automatically storing any configuration changes on an EAS device as a chronological list of configuration files. In combination with automated backups, HALO users are assured that the most current configurations for all EAS devices are saved. See Fig. 11.

Virtualization without regulatory changes

EAS at the Edge means leveraging the DASDEC as an edge device, speeding the implementation of a broadcast virtual environment without requiring time-consuming and uncertain regulatory changes. The required operations of EAS, including the specific attributes and functions of the physical EAS equipment, is detailed in federal regulation. This equipment is subject to an intensive FCC Certification process. The Federal Emergency Management Agency also has a hand in device requirements as well, since EAS devices were required to demonstrate product adherence through the FEMA Integrated Public Alert and Warning System (IPAWS) Conformity Assessment (CA) Program.

Given these regulatory and operational realities, the EAS at the Edge architecture reconceptualizes the role of the DASDEC well beyond a simple "EAS encoder/decoder." The DASDEC serves as a versatile edge device — an entry and exit point to the virtualized broadcast system and the interface between the virtual environment and the real world. As an edge device, the DASDEC collects and communicates information to and from the virtualized broadcast environment and external cloud-based environments for management and control and other purposes.

Above
Fig. 10: Simplified concept outlining the three IP protocols and company consortium.



Right
Fig. 11: Aggregation and monitoring using HALO, a fully virtualized EAS device management system.

Positioning the DASDEC as an edge device in a hybrid environment meets all the necessary regulatory standards, government approvals and certifications and is something many EAS participants have been doing for years. A DASDEC at the edge ensures that the critical EAS functions are not compromised and that the virtualized environment meets the necessary performance, reliability, and security standards.

Summary

To date, legacy EAS radio implementations have basically remained unchanged since the 1990s. EAS at the Edge is a revolutionary approach that brings the emergency alert process into the interconnected AoIP world by leveraging modern IP-based content distribution and control to route alerts precisely to their required destinations.

Additionally, EAS at the Edge helps extend the benefits of virtualization to distributed edge environments, such as isolation, mobility and ease of management, while maintaining all the required aspects of EAS operation and compliance. This implementation replaces cascading layers of hardware and multiple boxes with an intelligent, one-to-many approach, placing mission-critical hardware at the edges of the air chain to control and insert emergency messages that can be geo-targeted for precise alert routing.

Implementing EAS at the Edge is a comprehensive approach to modern station operation. It accomplishes the primary mission without further regulatory or substantive changes in EAS messages' structure or presentation. The flexible nature of IP-based systems ensures that EAS at the Edge complies with current regulations and can address future FCC regulations as they evolve. As a further testament, similar edge-to-edge systems have been successfully deployed in video environments for years.

With virtualized EAS device monitoring and compliance reporting, leveraging the power of software-based air chains is fully possible and available today with the right partner's technology.

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