



WHEATNET-IP

INTELLIGENT NETWORK

VIRTUAL • AUGMENTED • REALITY



# MAKING SENSE OF THE VIRTUAL STUDIO

SMART STRATEGIES AND VIRTUAL TOOLS  
FOR ADAPTING TO CHANGE

The word “virtual” can mean different things to different people.

In broadcast circles, for example, we often talk about virtual in terms of “putting the console behind a piece of glass” such as a Windows® tablet or PC computer screen.



Virtualization isn't an entirely new concept. We've been virtualizing studio functions since the very early days of IP audio networking, and not just on the surface, but inside the network, too. Early AoIP adopters will recall Wheatstone's Glass-E virtual mixer for the laptop and the introduction of virtual mixers at every I/O point on the network with the arrival of our WheatNet-IP audio network in 2008.

Virtualizing resources instead of limiting them to fixed hardware makes sense for a whole host of reasons, foremost among them the scalability and flexibility of software. So far, though, virtualization hasn't moved much beyond single-purpose use; that is, virtual mixers and other similar apps have remained largely fixed in purpose. But what if you had your own virtual development platform with the smarts to do virtually anything you want to do in the studio? What if you could determine what to put behind the glass or on a button, right down to its functions and when to perform those functions based on the status of a cross point connection in the network? How useful would it be to develop your own unique virtual studio that could not only take into account all types of user interfaces, but also be able to assign the right bus-minus by scanning the channels on a console for a certain codec, for example?

And, what if you could apply the same concept to hardware? What if your studio console could be as dynamically changeable as any software interface?

This next big advancement in virtualization hasn't been possible until now. With AoIP technology reaching the apex of maturity and more advanced virtual development tools becoming available, we can build upon existing AoIP infrastructure to transform workflow management and resource sharing for broadcasters, giving them the power to adapt to change. ●

# 5 PROBLEMS VIRTUAL SOLUTIONS CAN SOLVE

The entirely virtual broadcast studio is not only possible, but most of the pieces are already in place. A good majority of what stations do today – schedule music, stream it, record news updates, even turn on a mic and preload settings for it -- can be done without ever leaving the IP audio network.

If the goal were virtualization, we would already be there. But the reality is far more complicated. Producing great radio doesn't happen in a cloud; it takes a combination of the right talent, the right programming, and the right tools. Being able to adapt to the workflows you need when you need them can solve problems that were once difficult, if not impossible, to solve. Here are five:

## 1. Upsized content in a downsized operation

The volume of audio deliverables has picked up considerably due in part to social media, and will no doubt continue as 5G begins to flood mobile users with even more data. Meanwhile, both studios and staffing have shrunk in recent years. Virtualization can fill the gap. With today's digital and streaming services especially, stations can originate specialized programming without adding the physical rooms to manage those additional mixes.



## 2. Content is no longer coming just from the studio

Content can come from anywhere these days – the Internet, a sister station, or even a listener's iPhone. Virtual solutions give you the flexibility to generate content off of any surface, anywhere, and to tap into content wherever it can be found.



### 3. In fact, talent has left the studio

With talent no longer chained to one studio, or even the studio facility, it's more important than ever that virtual mixing and other studio functions are able to go wherever the action is. Need to voice track a segment from the airport? Record, edit and mix on a Windows tablet and send the result to the studio IP audio network from anywhere there's a network connection. The possibilities have been with us for a while, thanks to the advent of virtual mixers. Now, advanced virtual development platforms with scriptable interface, control and monitoring give us unlimited possibilities. One engineer we know even scripted a WheatNet-IP "alarm clock" to alert the staff should the early morning guy hit the snooze button one too many times.

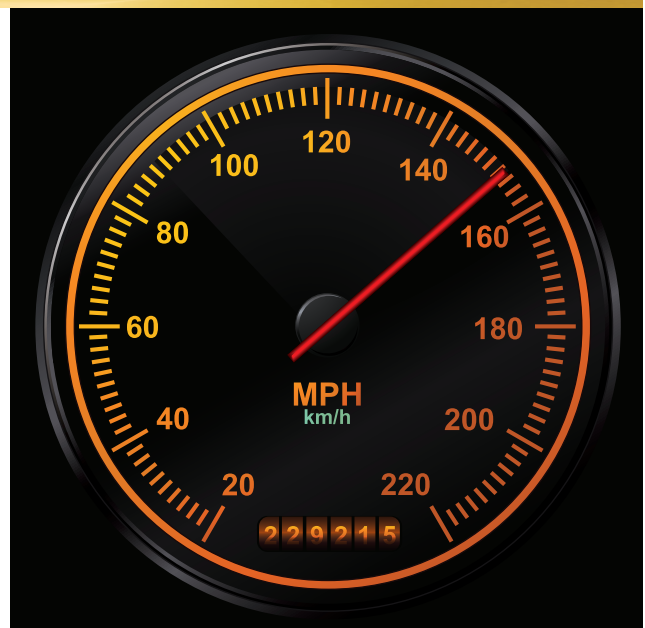


### 4. Consolidation

The latest round of consolidations involving iHeartMedia, Entercom, Beasley, and CBS serves as a reminder that stations are no longer islands unto themselves. With consolidation comes one of two challenges: having to cram more stations and their studios into one facility or having to manage more stations from one facility. Either way, virtualization solves all kinds of operational and logistical issues related to consolidation. Smart virtual will no doubt play a critical role now that the FCC has abolished the main studio ruling and stations can more easily share talent, resources and programming through one large centralized studio operation.

### 5. The accelerating rate of change

The current eleven-month doubling rate of technology known as "The Law of Accelerating Returns" is getting faster. We can't expect hardware to keep up with the rate of change, although for practical reasons, hardware interfaces, panels, switches and other devices will be with us for some time. The solution? Virtualizing hardware, which gives us the best of both worlds: the immediacy of software and the practicality of hardware. Console surfaces are probably the best example of this unique combination of hardware and software, from the use of simple touchscreens on the meter bridge to the entirely reconfigurable buttons and controls found on the LXE console. We will cover this in more detail later on in this ebook. ●



# MORE ON THE SURFACE

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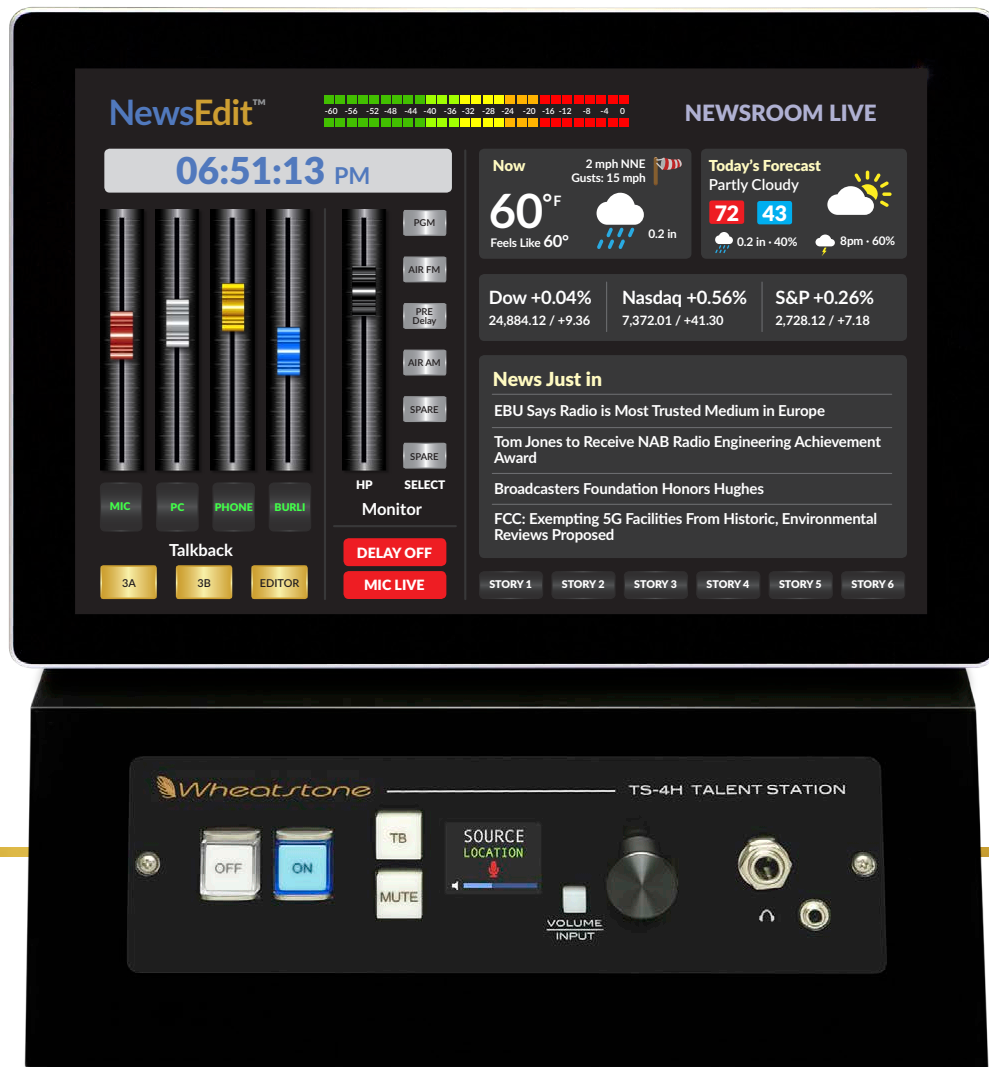
When Beasley Broadcast set up a remote studio built out of cargo containers at Las Vegas' Container Park several years ago, announcers initially broadcast from the location using a touchscreen interface that was essentially a bank of faders, knobs and other software widgets on a flat screen monitor recessed into the furniture.

Virtual mixers like this have become commonplace, thanks to software such as the Glass-E virtual mixer. This is just the start. The virtual interface to the IP audio network can now take on a variety of forms and applications thanks to the smart virtual development tools found in ScreenBuilder, which has a library of faders, meters, labels, buttons, clocks, timers, and other widgets that can be arranged on a PC screen or Windows tablet and then scripted to control devices and various elements in the WheatNet-IP audio network.

Not only can we develop customized virtual interfaces to the WheatNet-IP audio network, we can tie various elements to logic functions in the network and create an unlimited number of new workflows as a result. One screen can be the window into any number of functions, from transmitter control and source I/O to mixer interface and meter display.

**“I can send the morning crew out on a remote with Glass E on a laptop...And, here’s the thing: I don’t have to bring in another operator to run the board for a three-hour show at a remote site.”**

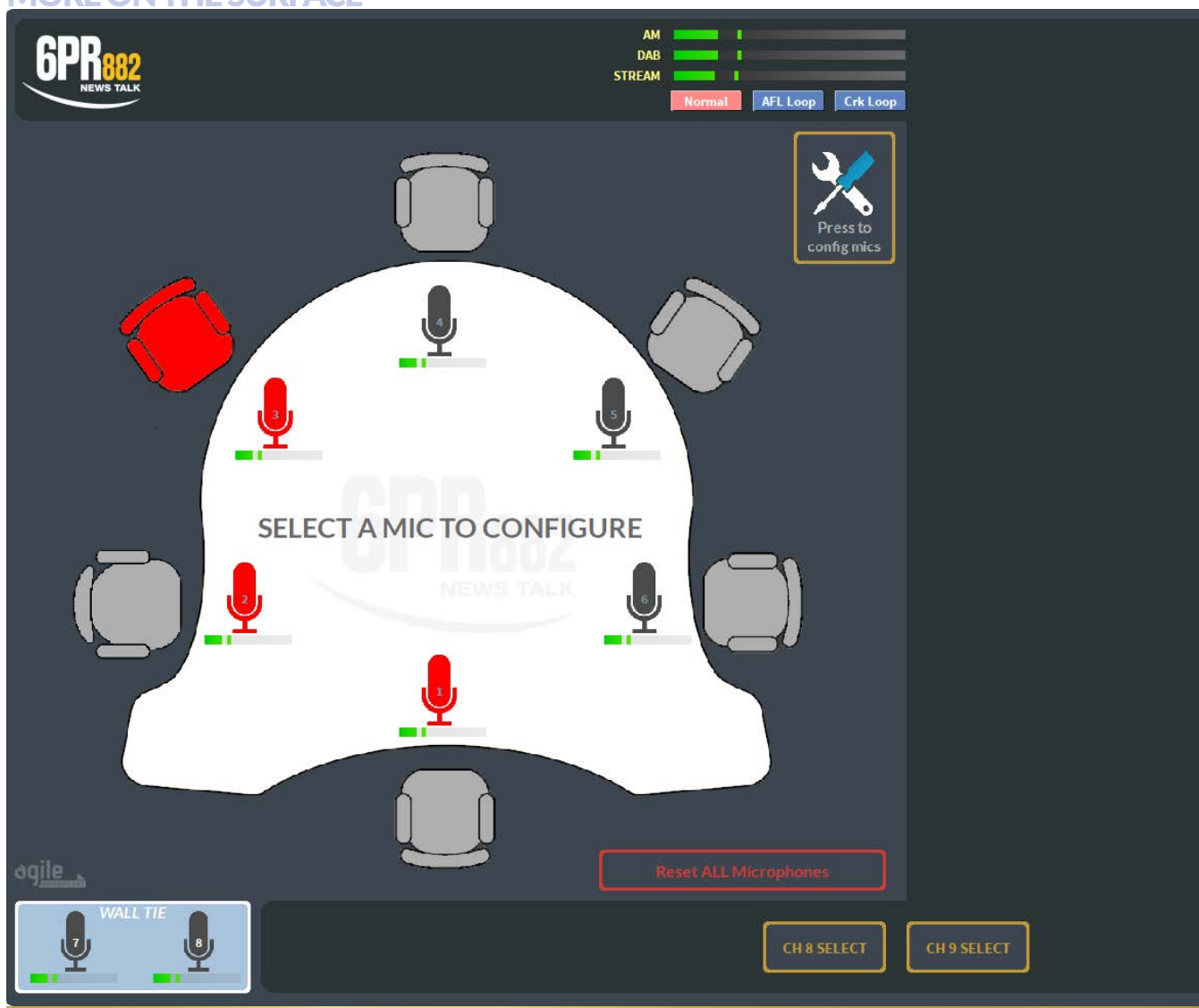
*Joe Schloss, Market Engineer,  
Saga Communications, Iowa.*



## Augmented Reality

This virtual news desk was inspired by Rob Goldberg with RadioDNA and Chris Penny with Agile Broadcast, parts of which came from various designs used in station installations. For the RSS news scroll on the right, a simple Visual Basic script was used to grab an XML file from the website and parse out the headlines for scrolling every few minutes. A similar script was used to pull in detailed weather reports from a weather channel and the stock market feed. The Windows tablet, combined with a modified TS-4 Talent Station which has cough button, talkback, mic input, cue speaker, and headphone jack as an element on the WheatNet-IP audio network, makes a standalone news desk.

**MORE ON THE SURFACE**

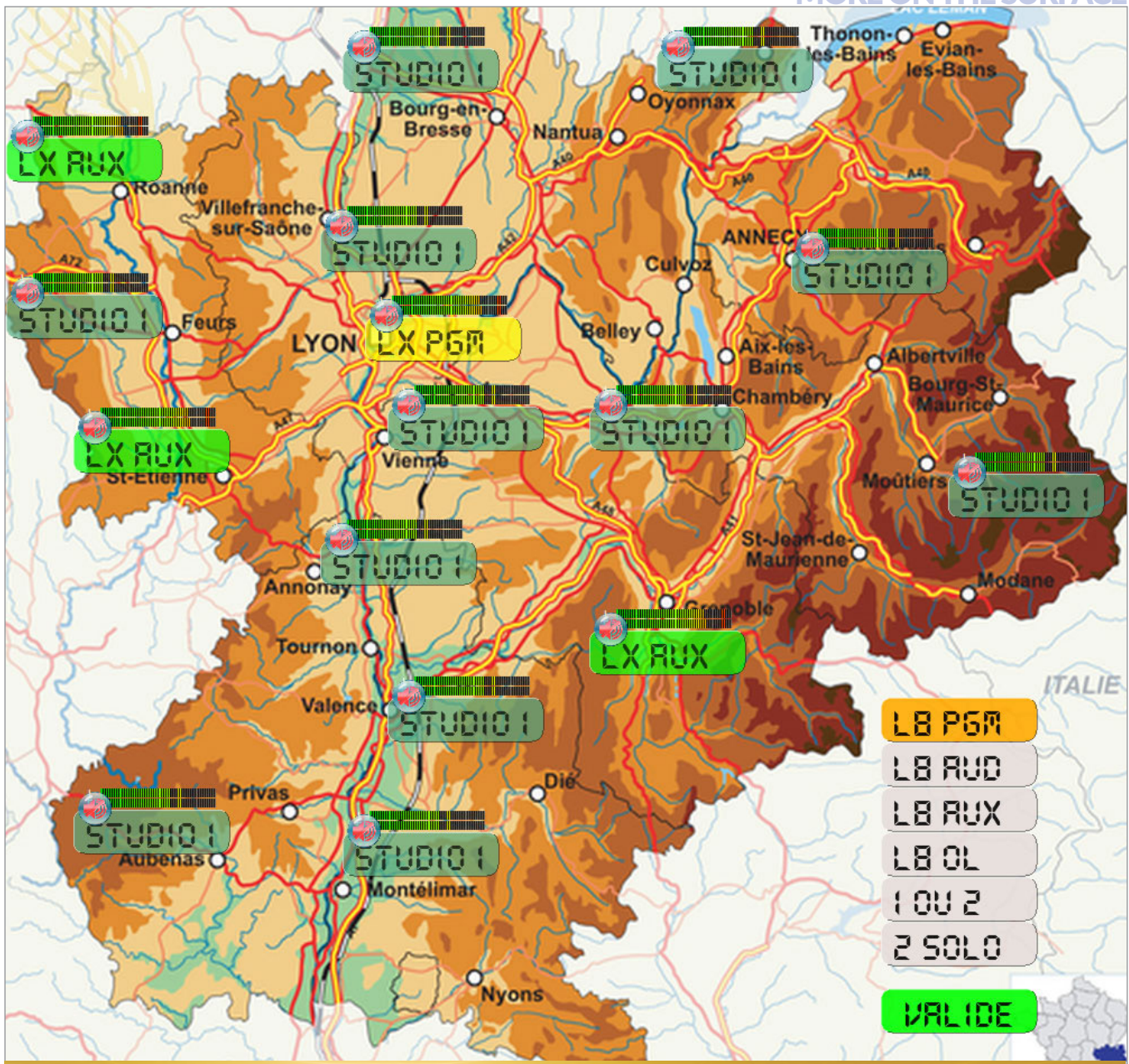


## Augmented Reality

This ScreenBuilder interface is a good example of how to augment the usefulness of existing hardware. A nine-channel LXE console was purchased with the specific requirement to automatically mix up to eight microphones down to one fader. The remaining seven faders are for phone, playout and outside broadcast sources. To accomplish this, microphones were grouped onto one fader and made accessible through this touchscreen interface shown.

*Screen courtesy of Chris Penny, Agile Broadcast*

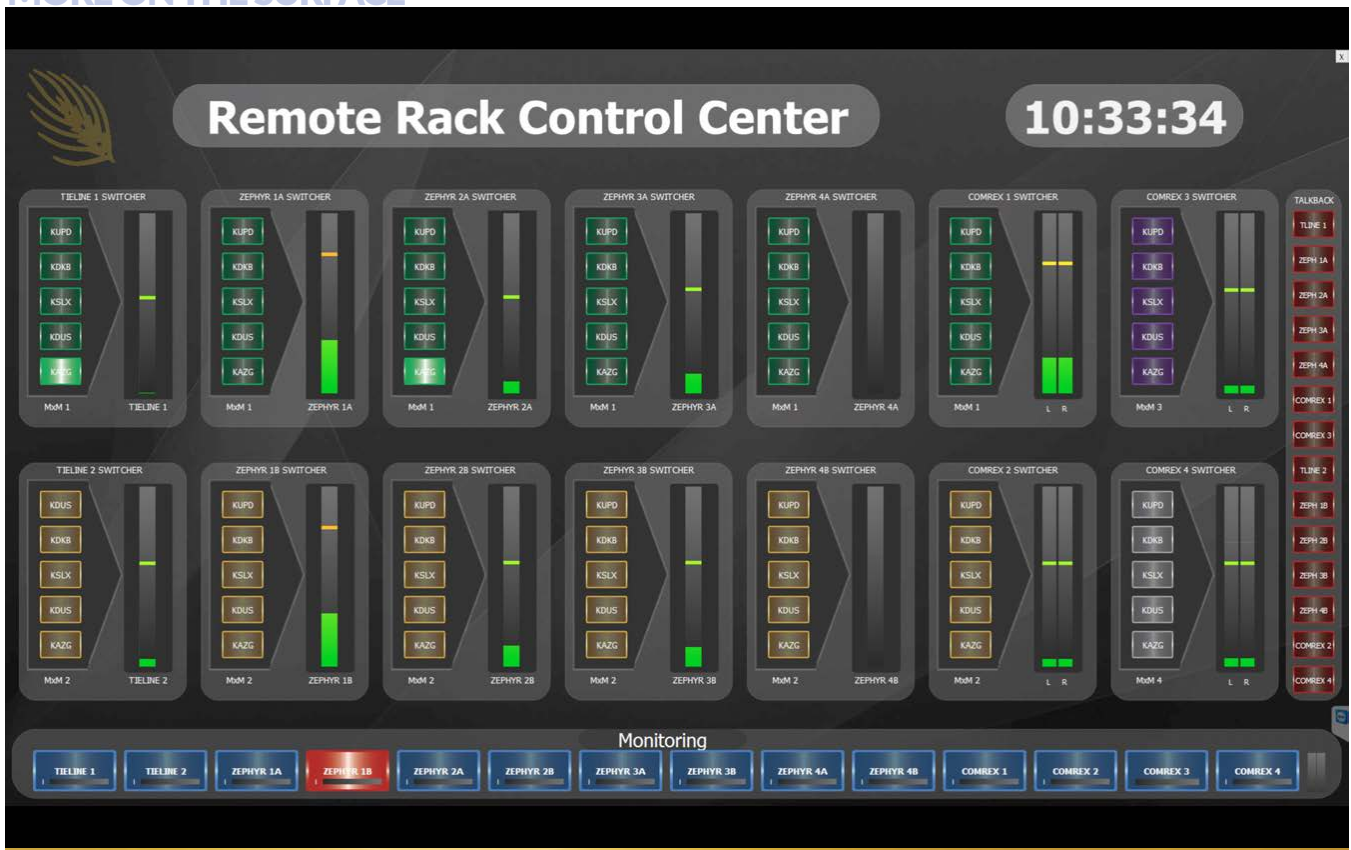




## Virtual Reality

This virtual control panel is used by operators to assign sources to different destinations and to monitor the real-time status of a wide area network of WheatNet-IP audio network I/O BLADES.

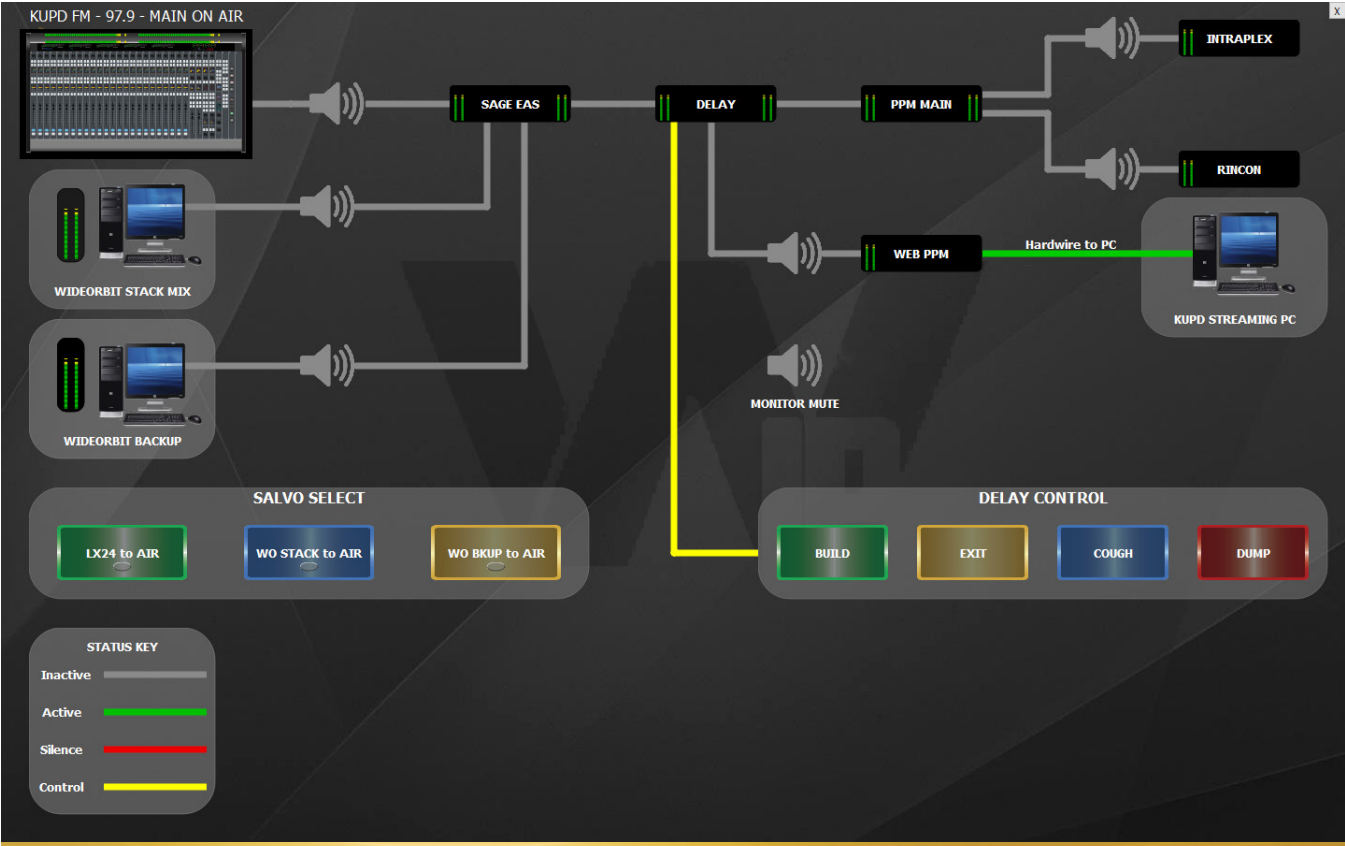
Screen courtesy of Rafael Dolmazon, SAVE Diffusion



## Augmented Reality

This screen in the Hubbard Phoenix rack room provides easy touchscreen access to the group's assortment of codecs for its five studios. Included are monitoring and talkback buttons for set up and testing for remotes.

Screen courtesy of Rob Goldberg, RadioDNA



# Virtual Reality

This virtual control panel for KUPD-FM, Phoenix, provides easy control and indication of the station's program flow, including salvo selection and delay control.

*Screen courtesy of Rob Goldberg, RadioDNA*



# CASE STUDY



Fig. 1

## RadiOhio on Smart Virtual Workflows

The world view from inside RadiOhio in Columbus, Ohio, can be summed up in a simple touchscreen interface that sits alongside the console in every studio. It is through this that talent are able to talk directly to just about everything that touches the WheatNet-IP audio network – LX-24 consoles, codecs, profanity delay, transmitter readings, and more.

This new window into the everyday operation of radio is made possible because of RadiOhio Director of Engineering Greg Armstrong, Staff Engineer Tyler Stark, and ScreenBuilder, a virtual development platform that ties elements on the network to onscreen buttons, meters, and other widgets.

### Behind the Screens

Like many broadcasters, Armstrong started out with physical button panels to make things happen on the network. Then, “We offloaded a lot of those functions onto ScreenBuilder because we could do a much better display and give the operator a lot more information than we could with the GP panels.”

Armstrong quickly discovered that many of the subroutines he used for blinking physical buttons on or off, for example, were directly transferable to ScreenBuilder. “Some of the code used for the GP panels proved to be helpful in building the screen interfaces,” he said.

ScreenBuilder widgets are drag and drop, and he assigned values to widgets for controlling or monitoring aspects of the WheatNet-IP environment.

In many cases, Armstrong was able to cut and paste logic routines and expand upon them for his own purposes. “We’re doing a lot of logic. We’re getting statuses from the outside world and we’re doing a lot of internal Wheatstone functions, like asking what’s connected to a particular destination and stating things like, ‘If the GPIO for EAS is routed, I want the lamp to light up green, but if it’s not routed, light the lamp red.’

“It’s not just clicking and tying a button to something. We’re getting into the network and asking it questions,” he added.



Talent in the AM and FM control rooms have total control over program channels, satellite feeds, profanity delays, IFBs, and remote codecs through this interface.

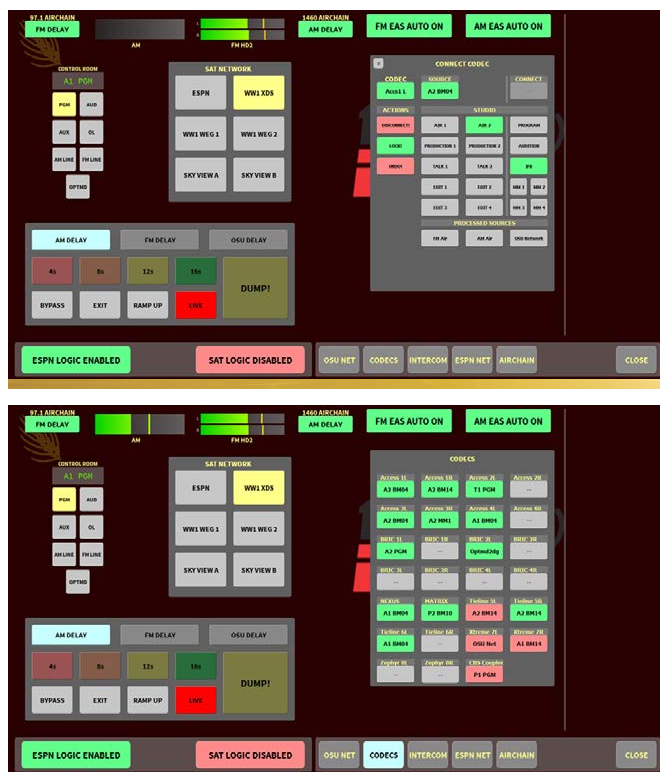
On the left side of the screen (Fig. 1, top page 12) are all the necessary buttons for control room buses and routing sources, as well as indicators showing the status of the return feed from the modulation monitor and the FM audio processor. RadiOhio automates satellite programming from ESPN, Skyview and Westwood One, all of which come into the LX-24 console through a BLADE utility mixer. Talent can select which satellite feed is routed to the mixer and view the status of that feed, whether it's audio only (yellow) or audio and logic (green).

Indicators tell them whether the logic for ESPN or other satellite program is enabled to trigger the ENCO automation.

In the past year, RadiOhio updated to Eventide profanity delay units with WheatNet-IP audio inside. Armstrong centrally located the units in master control and built widgets on ScreenBuilder for operators to control the delays from any studio.

Hidden on the right side of the screen is an annunciator panel of indicators (see fig. 3) that will flash in the event of a NOAA weather alert or if the AM or FM goes silent for any reason.

Fig. 2A top Fig 2B bottom



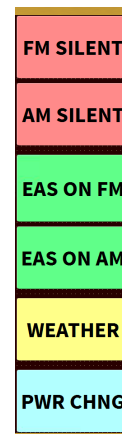
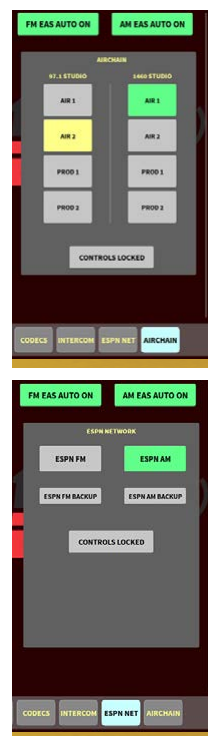
Putting codec selection and IFB routing onscreen markedly reduces the time and complexity of setting up remotes by talent, in particular having to change the fold back on the IP codecs shared by the primary AM studio and the primary FM studio. Instead of having to open a cross point on the network and change the codec to the correct bus-minus, they now select codecs from a menu on the right (see fig 2B) and the system scans the console inputs to find out which channel the codec is sitting on and assigns the appropriate bus-minus.

Talent can easily select which studios are tied to which air chain by first pressing the “controls locked” button twice, which reduces the chance of someone making an unintentional change that could result in dead air. “For all our critical controls, we make it so they have to press the button once, and then again to unlock the controls. If they don't press it that second time within three seconds, it defaults to locked,” explained Armstrong.

Instead of a physical button panel for AUX and PGM in each talk studio, these can be selected onscreen along with the air studio they're tied to.

RadiOhio's The Fan 97.1 originates college sports programming to 80-some affiliates nationwide and broadcasts ESPN programming to local listeners. When the station's ENCO fires a local break relay or ID to the affiliates, announcers receive a visual confirmation that the affiliate has received the relay. A button on the lower left of the screen that is tied to the LIOs coming out of the satellite receiver changes from green to yellow and then to red to indicate that the relay has been received. Relays also can be fired directly from the screen, should the announcer need to bypass the ENCO system, and profanity delay for the sports network is floating as a separate function tied to the sports network so that it can be activated no matter which studio the sportscast originates from.

Fig.3, right This image is of the “hidden” annunciator buttons on the right side of the main screen that flash when active.





## FEATURED SCREEN



# THIS IS THE SCREEN THAT BLEVINS BUILT

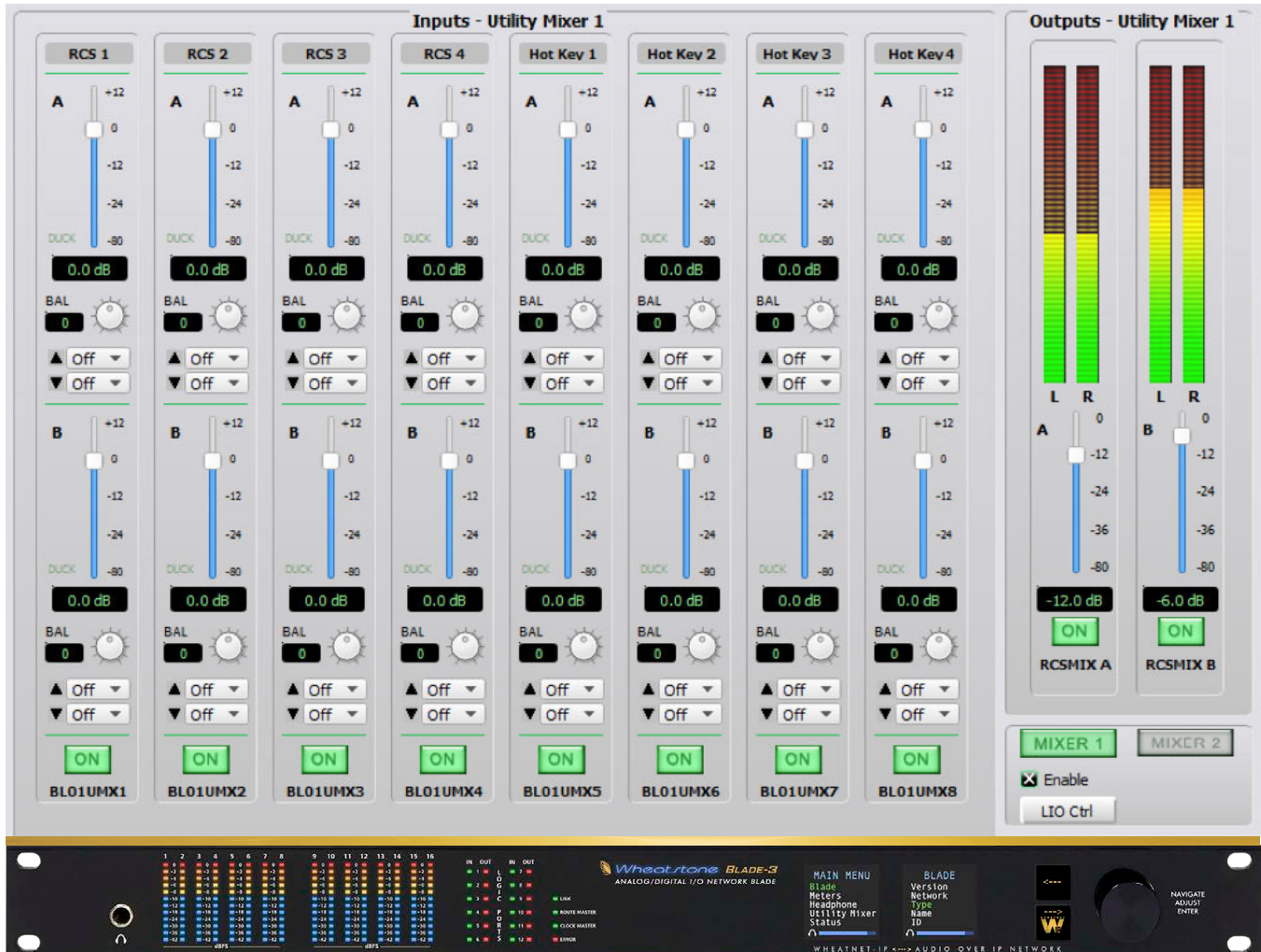
IMG World Chief Engineer Ben Blevins designed this customized interface using ScreenBuilder to help his producers navigate over a dozen sports games, often in real-time and on the fly, for a “Red Zone” channel that features highlights from college football coast to coast. “We built this little all-in-one access panel, so they can have access to everybody at once as a sort of intercom, complete with their own headphone mix to monitor all that is going on and to drive the show where it’s going next,” he said.

On any given Saturday, IMG World produces 40-plus games, each with one or two sportscasters reporting in from different ball parks and fields anywhere in the nation. All feed directly into IMG’s Winston-Salem’s WheatNet-IP networked studio complex, where it is all produced and redistributed to any number of its 2,200 affiliate radio stations. ●

See Ben demonstrate this Screen at: [wheatstone.com/img-ben](http://wheatstone.com/img-ben)

# BEYOND THE SURFACE

We can now source, route, mix, and send to air from just about any device imaginable, in some cases without touching a single physical fader.



Virtualization is not only happening on the surface, it's happening inside the network as well. For example, there are two utility stereo mixers in the I/O BLADES that make up our WheatNet-IP audio network.

By adding virtual stereo mixers to the I/O unit, mixing is no longer limited to a location in the studio. Mixing is an available resource on the network that can be used to mix-down or split channels on site at, say, a sporting event, or for creating an intercom system. In short, background mixing can now happen independently from the console surface. Mix-minus can be triggered in the field from a virtual button panel, or a Windows tablet in a production truck or centralized studio.

Virtual mixers at every connection point in the network make it easy to group mic outputs into a single output, segue remotely between feeds, overdub and pan, set up IFBs on the fly, and so much more ... virtually anywhere.

Add to this the ScreenBuilder factor, and we can now source, route, mix, and send to air from just about any surface imaginable, in some cases without touching a single physical fader.

The possibilities get even more interesting now that we added dynamic EQ and other virtual audio processing tools to I/O points in the network. We can now "spot process" satellite feeds, headphone audio, web streams and other audio feeds virtually anywhere on the network. ●

# BUILD YOUR OWN

Time was, if you wanted a customized studio you had to literally build it yourself. You needed rows of hardware, spools of cable, and a decent soldering iron. Today, with virtual development tools, you can add on a new studio using little more than a Windows tablet or screen and your existing IP audio infrastructure.

ScreenBuilder talks to elements through a WheatNet-IP audio network control protocol known as ACI, as do third-party products such as automation systems that have ACI added.

ScreenBuilder widgets come with basic software scripts for performing functions. For example, faders are able to adjust levels and switches can turn on or off a microphone. These can tie into LIOs anywhere in the network to control elements, and ScreenBuilder can set up routines to check the status of tallies and cross point connections to execute if/then commands. ScreenBuilder can query a fader to find out what source it's connected to – and have the name automatically appear on the screen in front of you, eliminating having to manually identify and type in the source every time there's a change.

Wheatstone's Script Wizard, which started as a script generator for general purpose buttons used in the WheatNet-IP network and has evolved as a basic script generator for ScreenBuilder, provides basic scripting. Creating customized program routines is often as easy as navigating a checklist of salvos, destinations and sources. For example, you can tell Script Wizard you want to monitor fader 1 on one of the two utility mixers in a specific BLADE (we'll talk about these virtual mixers in a minute), and it writes that script for you automatically. For a little more customization, you can cut and paste an existing Wizard script into a work area and make any necessary



modifications. These “starter” scripts can be useful for developing customized functions shared by stations and more complicated functions can be added using Boolean and other common commands familiar to anyone who has some programming experience. Scripts and all images for those scripts are self-contained in one file folder so they are easily transportable from one studio or one screen to the next.

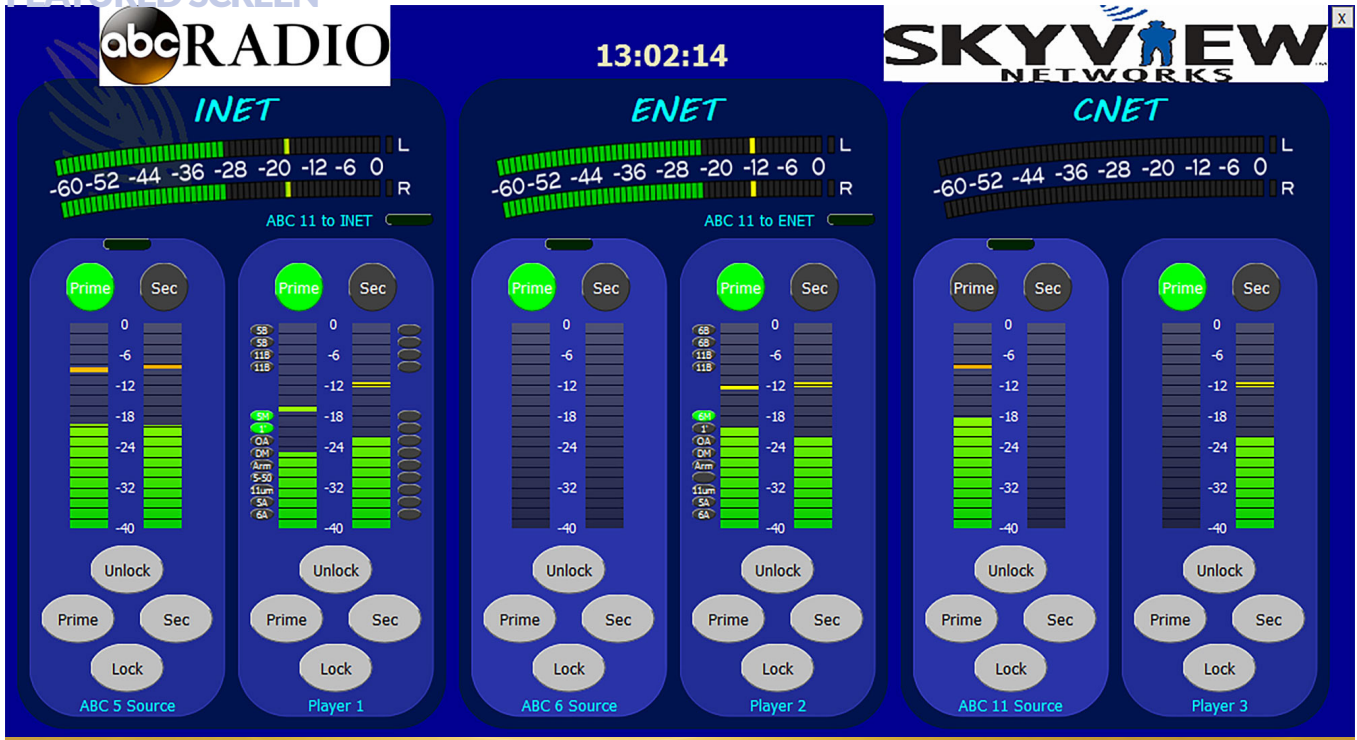
ScreenBuilder can also use third party Windows apps that already exist. Instead of writing a script routine to capture a weather feed, for example, ScreenBuilder can ask third-party apps to do it for you. “All you really need to do is tell ScreenBuilder to watch the weather gal on this channel, get the weather and put it on the screen,” said Agile Broadcast’s Chris Penny, who has developed dozens of virtual interfaces for broadcast studios. ●





ScreenBuilder faders, meters, labels, buttons, clocks, timers, and other widgets tie into function commands and elements on the WheatNet-IP audio network, which is a complete ecosystem of consoles, talent stations, I/O units, and accessories. At your fingertips are more than 50 different types of elements that can be connected together through the WheatNet-IP audio network, and countless third-party products that can be integrated into the network, including other networks that also are AES67 compatible.



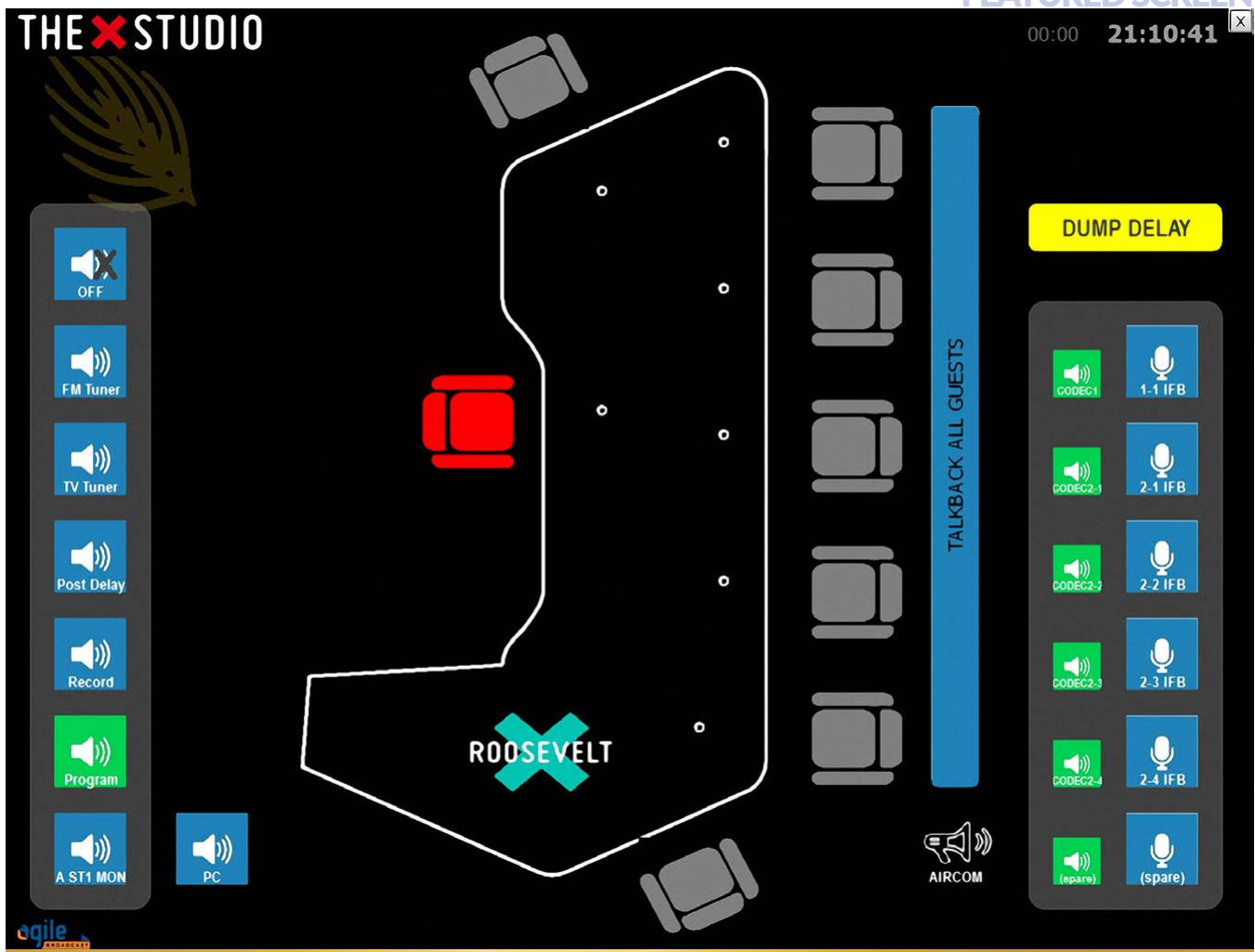


## A TALE OF TWO CITIES. MAP INCLUDED.

Here is a snapshot of a customized screen created with ScreenBuilder showing primary and secondary paths of ABC news feeds between New York and Scottsdale, Arizona. While ABC Radio news announcers are talking live in New York, their mics are managed by Skyview in Scottsdale. Wherever you are in the world listening to ABC

Radio news live from New York, you can be fairly certain that the signal is coming through Skyview Networks in Arizona. It takes less than a second from the time their lips move to the time the audio comes out of the speaker on your car radio, including up/downlink to the affiliates. Now, that's virtual! ●





## OUTTA CONTROL

Chris Penny of Agile Broadcast in Australia developed this virtual producer workstation using ScreenBuilder. The producer can bring IFB in to the right channel of a host/guest headphone by simply pressing on their chair. The 'dot' in front of the chairs (on the desk) lights up to show the mic is switched ON. Buttons to the right give the producer full monitoring of all outside broadcast lines in the facility, and he or she can talk to any remote talent by pressing the IFB button for the desired line. Group talkback to all guests is available by pressing 'talkback all guests'

or to every headphone by pressing the Roosevelt button (Roosevelt is the name of the studio). A source selector on the left side of the screen allows the producer to monitor a variety of program sources, and a PC button mixes in the producer's Internet computer to the monitor mix. Additional controls include delay DUMP (which illuminates when delay is full) and Aircom, which sends the producer's talkback microphone to the On Air mix via an AirAura processor (to color the sound so it mimics an intercom)."

# ON THE HARD SURFACE



## The move to virtualization started with the virtual mixer. Then, broadcasters began developing their own unique virtual interfaces and along the way, something unexpected happened.

“It turns out that what we’ve learned about software apps is directly transferable to hardware,” said Kelly Parker, Wheatstone’s field engineer who oversaw the design of a new configurable console based on his years in the field designing and installing new studios.

By making hard surface controls completely programmable – and continually re-programmable – through a GUI similar to ScreenBuilder, we can say goodbye to fixed hardware. Instead of mapping physical switches, buttons and knobs to a particular function on the console that can never be changed, any physical button anywhere on the LXE console can be programmed at any time for talkback, cue, start/stop or for toggling between functions, which can also be tied to different elements on the network such as microphones.

We owe much of this adaptability to the maturation of IT and the evolution of Linux in particular. “We’ve gone to Linux kernels that are easy to manipulate, and a lot of them are open source so we can run them on different kinds of back ends, and that opens the game up to do all kinds of things,” commented Parker.

Among the many new capabilities resulting from this flexible architecture is a more dynamic split-console configuration, whereby two or more board ops can work off of separate LXE fader banks in the same room or separate rooms networked together in order to share mutes, tallies, speakers and other resources. Until now, there were limitations to splitting up fader banks. “IP audio consoles were traditionally bound to one mix engine for every surface and that really limited how they could be used,” explained Parker. Close collaborations of this nature often required a complete console reboot, making real-time sharing of resources and mixes impractical for many studio workflows.

With this new flexible architecture, we now have the ability to network multiple surfaces through a shared I/O engine or network a surface to multiple engines. With multiple consoles accessing a common I/O point, talent can share sources and feeds in real-time, plus open and close mics, apply signal processing, handle IFB backlinks and essentially work closely together from separate LXE fader banks located anywhere inside, or outside, the studio. They can even co-produce from an auxiliary LXE Windows tablet in real-time while another board op is actively producing on the main LXE surface!

All the buttons and surface hardware on the LXE is programmable through standard scripts that can be set up through ConsoleBuilder, a platform similar to ScreenBuilder but specific to LXE. You can write your own custom scripts to create functions unique to your studio, and add your own graphics, logos and images as needed. Even more significant, you can do so much more with the hardware you do have. One button can do a myriad of functions; it can change color when it changes state to another function, for example.

In addition, remember the virtual news interface we told you about earlier, the one with clock, weather, profanity delay status, mic status and RSS feed all on one handy virtual screen? You can add this or any customized screen of your creation onto the LXE desk. Everything is on one, multi-function screen for monitoring and controlling elements in the WheatNet-IP network as well as news feeds from a local channel or weather feeds from NOAA.

The LXE forever console is the first of its kind that can be reprogrammed for any application, any time. ●

# CASE STUDY



## Drive Time All the Time

It's drive time all the time for 107.7 Sanef located near Senils, France. That is, the station broadcasts to traveling motorists through a network of 200-watt transmitters synchronized on the same frequency and located along 1,800 kilometers of motorway.



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**107.7** Sanef broadcasts a music format but as a highway station, it has an added responsibility to broadcast emergency and traffic alerts anywhere along the roadways it covers. That's where ScreenBuilder comes in handy.

ScreenBuilder is used to create custom touchscreen interfaces for adjusting, monitoring and controlling different aspects of the WheatNet-IP audio network. In this case, SAVE Diffusion, which represents Wheatstone in the region as a full systems integrator, used ScreenBuilder to create a touchscreen interface so 107.7 Sanef operators could easily select and target news updates to one or more areas of the broadcast network.

In addition to WheatNet-IP audio control surfaces and talent stations, each of 107.7 Sanef's three studios are equipped with eight screens and screen images of the motorway network cameras. The three studios are networked together using WheatNet-IP audio networking. At the heart of connectivity

are WheatNet-IP I/O BLADEs, which have embedded intelligence for signal detection, automation logic, sound processing and emergency interrupt of programming at each connection point in the network.

Sanef 107.7 broadcasts a pop/rock format when it is not providing critical traffic information to its listeners.

As part of the WheatNet-IP audio network, the touchscreen is often accessed at monitoring stations at various points along the roadways, but it could just as easily be accessed from anywhere in the world via a remote management tool.

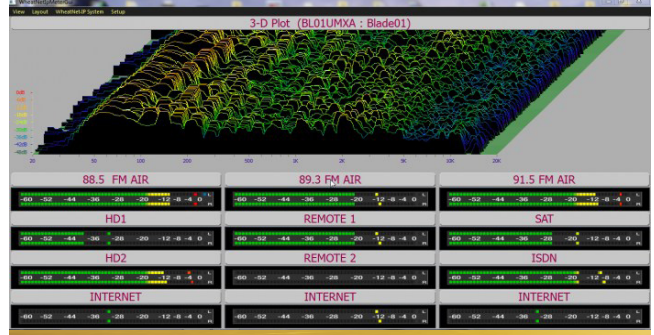
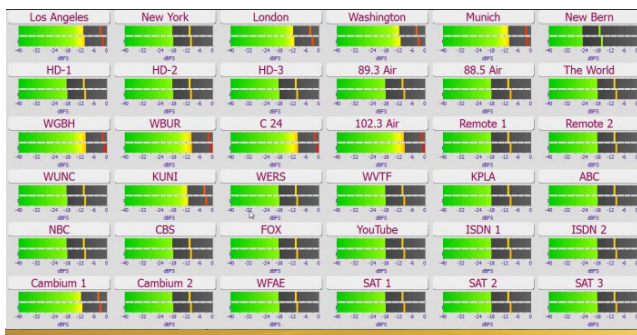
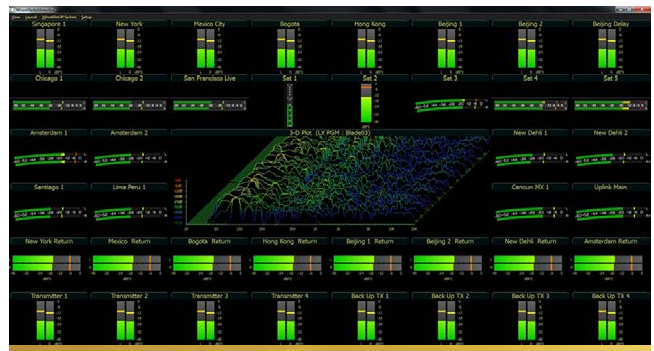
Now, depending on where an event is taking place, operators can target listeners anywhere along the broadcast network to let them know of an upcoming accident or traffic jam, or if another motorist is traveling in the opposite direction, for example. Meanwhile, elsewhere in the broadcast network, operators can alert motorists of a breakdown up ahead or a large object or animal obstructing the roadway. ●



# IP METERING 101

Virtualization happens even when nobody's looking. Audio signals are constantly being monitored and controlled by algorithms that run the network. Today's customization metering tools such as IP Meters give you realtime metering anywhere in the network of audio levels, signal density, FFT graphs and more.

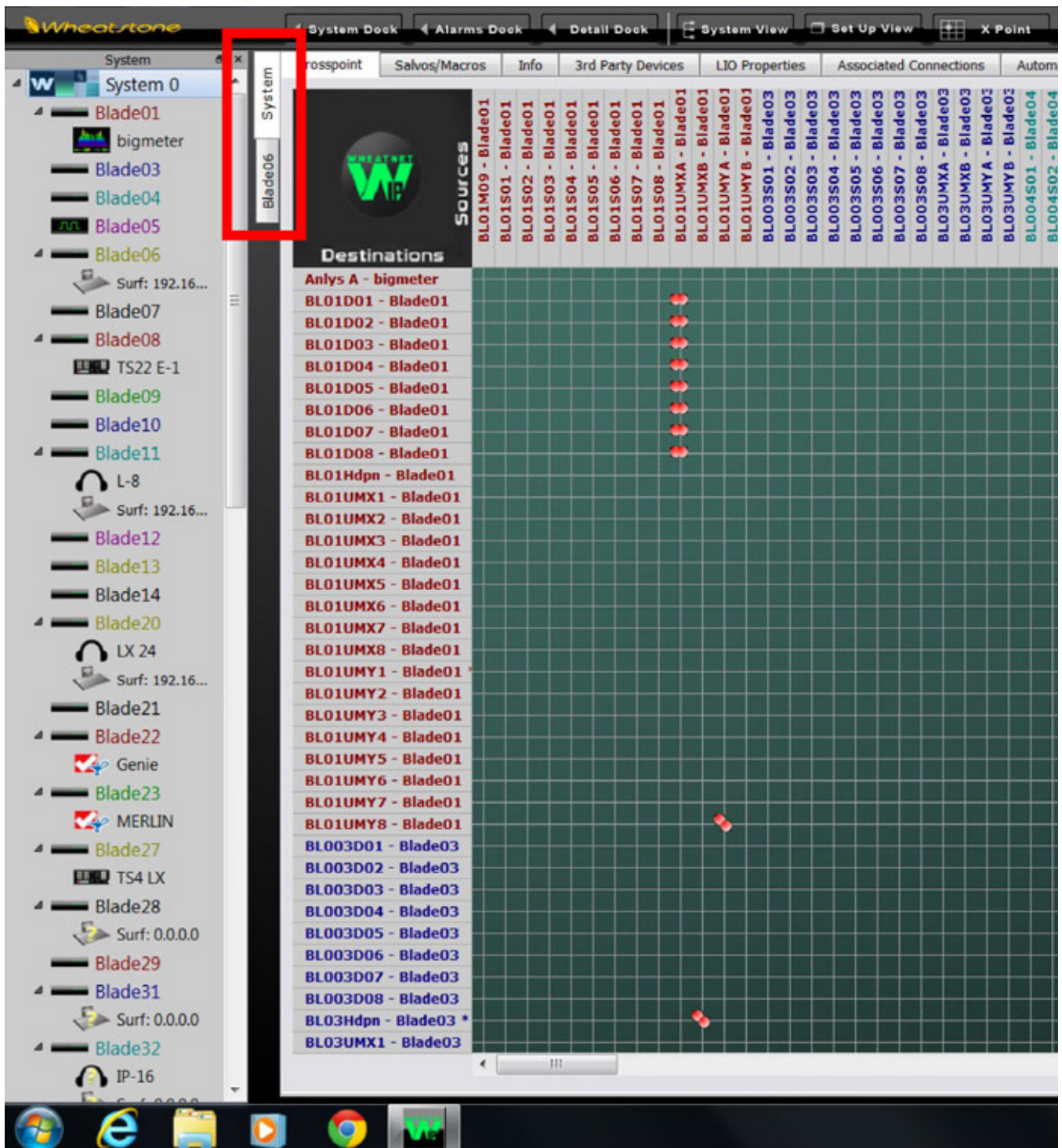
Here are a few examples.





# THE NERVE CENTER

ScreenBuilder tools work in conjunction with Navigator to be able to determine when, where and which functions to perform based on the status of a cross point connection.

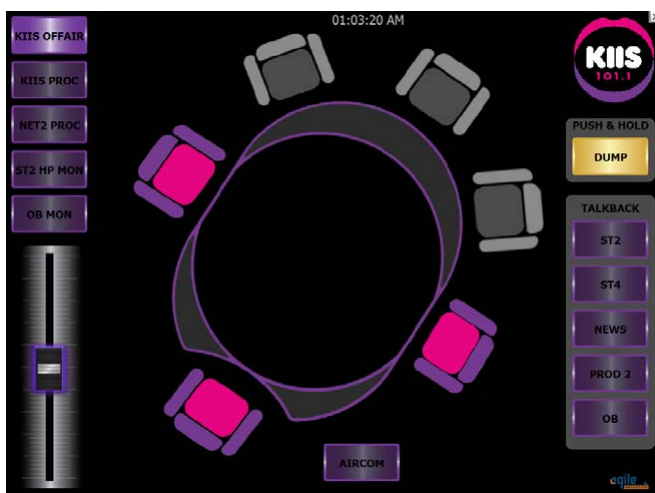


# A SCREEN BUILDER GALLERY

It amazes us what people do with the tools we build. Here's a small sampling of ScreenBuilder projects our friends from around the world have come up with for streamlining and customizing their workflows. We can't wait to see what you come up with.



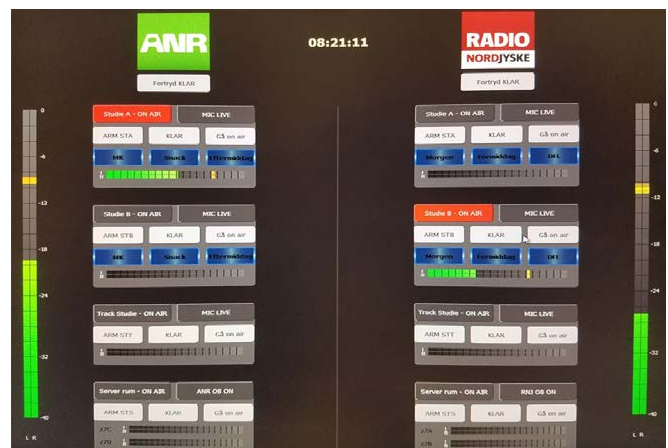
1. SAVE Diffusion's Rafael Dolomazan put together this screen which provides control over a live show, complete with specific console and automation functions.



2. Using this simple virtual panel, producers can press the desired chair to bring up a monitor mix or simple intercom and control profanity delay as needed.



3. This is an advanced monitoring panel used in live racing. It shows (and can mix) the 24 channels available on the LX-24 surface. The MM1 and MM2 buses are controlled here and feed the left (MM1) and right (MM2) sides of a commentators headphones. Commentators can listen to multiple contribution sources in each ear, and raise the audio level of up-and-coming races by double-clicking the source. This brings the most important races to the forefront of the monitor mix. This unique implementation adapts to the ad-hoc nature of the content, allowing the commentator to concentrate on the important information as it happens – all while being able to keep an eye on upcoming events.

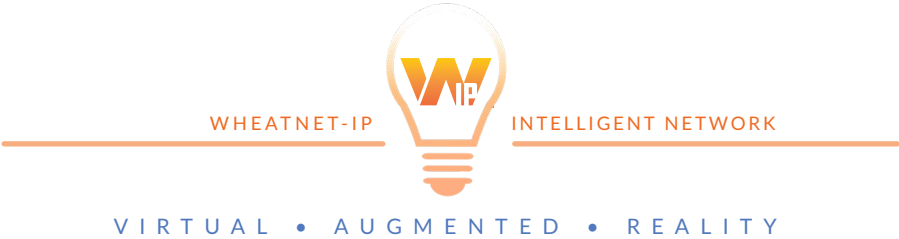


4. Henrik Poulsen, CTO for Radio Nordjyske in Denmark, designed this control panel for easily switching routing to their transmitter sites.









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