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Control Is the Word

New ways of looking at remote control and site management

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FUTURE

APRIL 2021

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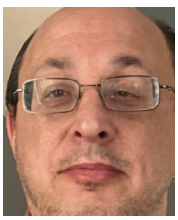
Control is the word

Getting the most out of your remote control and management systems

Writer



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Services

LOGIN:

Monitoring and Control — call it M&C — isn't just for transmitters anymore. What began as a matter of regulatory compliance is now just as much about sustaining business operations as a best practice.

As with everything else in this era of constraint predicated by COVID, whatever story Radio World may have written about control in 20XX would not be the story we would write right now. Monitoring and Control is now also about access and configuration.

A VERY BRIEF HISTORY

Transmitter sites for radio and TV have been tended by remote control, as allowed by regulation, for close to 45 years. When the downsizing of transmitter staffs began in the early 1980s, stations usually still had operating staff at the studio site, and this was often the designated extended or remote-control point.

In 1995, as solid-state transmitters, digital control and automation increased in use and reliability while allowing for reduced studio staff, the FCC further relaxed the regulations for operating personnel.

Technological advancement and changes to operating regulations soon allowed one system to monitor and control multiple markets from almost anywhere. The rise of reliable Automatic Transmitter Control, or ATS, reduced the necessity of direct and routine human interaction. Many station clusters had one person handling remote monitoring and control who could visit a site or dispatch someone if necessary. This was still largely focused on transmitter control.

As telco loops and phone lines gave way to modern communications circuits, the technology choices used to create and support the studio/transmitter link expanded. These too needed monitoring and control. Power quality and cooling were no longer just concerns for the transmitter.

And then COVID provided a test of just how well

those plans were working. Yes, we could still monitor and control, but what if that one person tasked to M&C was now unavailable? And how would we monitor the systems at the studios, which might no longer have a regular presence by technical or operations folks?

WHERE WE START

M&C in the era of COVID has become equally a concern of access and configuration for monitoring and control.

Transmitter remote controls have always been something of a black art, comprising well-intended boxes that connected by unique interfaces to devices that were never quite ready to be tethered to and controlled by a connected world.

For this article we talked to engineers and product managers from our ebook sponsors Nautel; the MaxxKonnect Group; Shively Labs and its partner TJH Systems; Burk Technology; and Davicom, inviting their insights on this topic.

An important note to readers in the United States: AT&T and Verizon in 2008 laid out and received FCC approval for a "10-year plan" to execute the sunsetting of analog telephone and ISDN services. A decade later the commission approved a final technology transfer plan.

The delay of the inevitable is now up. The FCC has given the green light to sunset legacy TDM services. As of August 2022, telecom companies are permitted to stop supporting legacy POTS and ISDN.

So as this further aspect of analog communications is about to close, broadcast managers and engineers need to ask themselves: How is my remote control connected and accessed? What is the connection at the control point? Will the control point be able to connect to "the other end"? Will I still have communications and access for monitoring and control four months from now?

Monitoring and Control involves the supervision of equipment performance to maintain operations within regulatory constraints with the intent to identify emissions that may cause interference or other harm and take corrective action, including shutdown, in a timely manner.

Attention to other purposes and systems is secondary insofar as regulations are concerned. Management wants to know how we use this expense to keep the transmitter on the air. The FCC wants to be sure that your expense can take the station off the air — automatically if necessary.

So when considering how to keep building systems on the air, you also have to consider your ability to take a station off the air, reduce power or interrupt regular programming when requested to do so by an authority having jurisdiction.

Monitoring is now often unattended. This means the ability to monitor site operations and notify a take-action resource when a parameter is out of tolerance. That monitoring may occur within the local system and notify an off-site resource.

Control, often in response to monitoring, usually means ***unattended*** control. A mix of local and remote automatic or semiautomatic systems are typical.

What has changed significantly in the last two decades is that these systems are no longer secondary to the presence of a human operator. They are not being used "until someone shows up." Control often entails replacing a human operator; and even servicing may be remote or performed by a non-technical person who receives instruction for a knowledgeable but distant resource.

> **"We look for availability, reliability and maintainability. These are a balancing act."**

Control, via automatic and remote means, is now often the primary control. Redundancy therefore isn't just for the transmitter, but for the systems that the transmitter connects to and the control system itself. Being able to connect reliably to the control system has become as important as the control system and the systems that are being controlled.

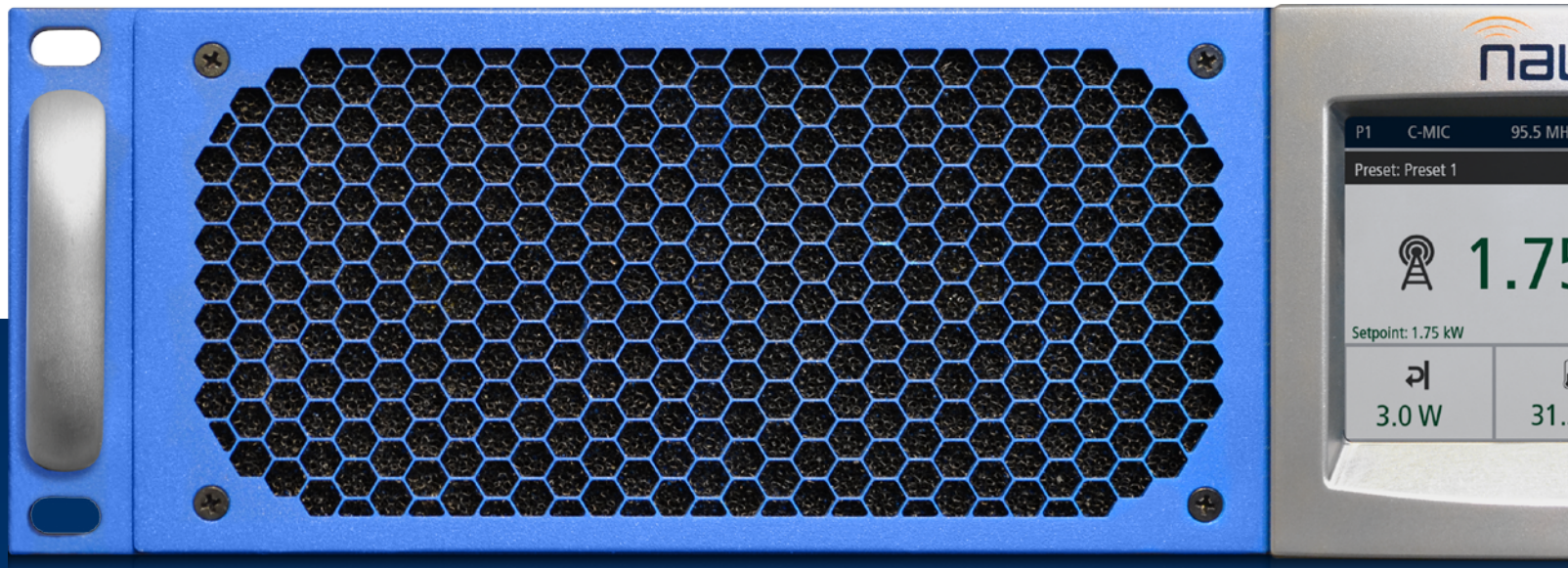
WHAT IS "AUTOMATIC" OR NOT?

Discussion of automatic control needs a sidebar:

Your author has studied what "automatic" means in a practical sense, especially for mission-critical concerns such as broadcast. In automatic control, we look for availability, reliability and maintainability. These are a balancing act.

Availability means just that: the probability that the resource is ready to use for the desired purpose when called upon.

VX Series



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Reliability means that if I choose to use a given resource, will it support the function for the duration of the event without any failures?

Maintainability tends to have different interpretations in some industries. Broadcasting usually thinks of "maintenance" as routine inspection, but not necessarily routine servicing. This leads to a false sense of security and a waste of resources.

Maintainability means: Can the device be serviced with a minimum of effort in a reasonable amount of time? Proper maintenance activities usually involves taking down a resource for inspection, test and service, during which the device is neither available nor reliable. Thus maintainability, being able to test and service the system, is the third concern in the design and operation of automatic systems.

Expecting a resource that you do not touch and test regularly "under load" to be otherwise available and reliable creates an Achilles heel, an "out-of-sight is out-of-mind" problem for remote control. It has thus become common to have tertiary systems that allow a "backup to the backup" for use when a primary or secondary service is down for proper maintenance.

When was the last time your transmitter generator was tested at 30% or more of load once a month for 30 minutes, and the test was initiated by pulling the primary source? Using the "Test Switch" on the front of the ATS will typically bypass some of the automatic logic that is part of the system, and thus is not a valid test.

Do you test once a year at 80% of load for an hour? When did you last test your "backup transmitter" during weekday PM drive? Why are you not confident to test it then?

Most hear the terms "automatic," "fail-over" or "fail-safe" and think they refer to automatic reliability. That is not necessarily the case nor is it a proper mindset when developing a system plan.

Yes, you want to plan your remote control on paper first, because software doesn't care about cable labels. Fail-over usually means that secondary systems listen to the presence of primary systems and take an action if the primary is lost. It can be a mistake, however, to have the secondary system automatically return to the primary without some supervisory intervention, human or otherwise, to determine if it is a good idea to return to the primary.

An automatic and unsupervised switching from primary to secondary system, then back to the primary easily can lead to a "see-saw" or circular total failure of a system.

Fail-safe is a term familiar to facilities and IT managers and now heard more in broadcasting. It may not however mean what you think it means.

Fail-safe means that when a part of the system fails, the control system relaxes to allow for the safe passage or service by personnel. Power supplies and amplifiers shut off, doors unlock, etc. The requirement for a remote-control fail-safe means that when control is lost, the transmitter shuts down!

Fail-secure means that when a part of the system fails, the control system raises the bridge and lowers the gates, doors lock and external connections may be interrupted, which could lead to a denial of remote access. Manual and local overrides are often necessary to reset fail-secure systems. Regulations do not allow for fail-secure. It is important to identify your risk culture when planning a remote-control system.

Peter Burk, president of Burk Technology, is experienced in providing control systems that can encompass transmission site control beyond just the transmitter. He highlights the rise in use of Simple Network Management Protocol or SNMP as a specific technology that is well suited to aggregation of a multitude of systems into a common and efficient platform that replaces legacy GPIO with a standardized communications channel that can be bandwidth efficient to the end user.

While SNMP has been offered for some time by various manufacturers, its use has seen limited adoption in the United States until recently.

WHERE ELSE NEEDS M&C?

Let's talk about the studios for a moment.

As a consultant and integrator, I'm amazed at how often broadcasters overlook the changes in workflow that now require remote access, monitoring and control for the studios, the benefits of doing so and the necessity of proper infrastructure that is required.

In the last two years, remote monitoring and control of studio systems and operations has become an unanticipated but desired capability as well. Some current audio automation and console products, by virtue of their IP connectivity, can provide operator and automatic interface that could operate items at the transmitter, thus offering relativity inexpensive options for control or control backup.

"When did you last test your 'backup transmitter' during weekday PM drive? Why are you not confident to test it then?"

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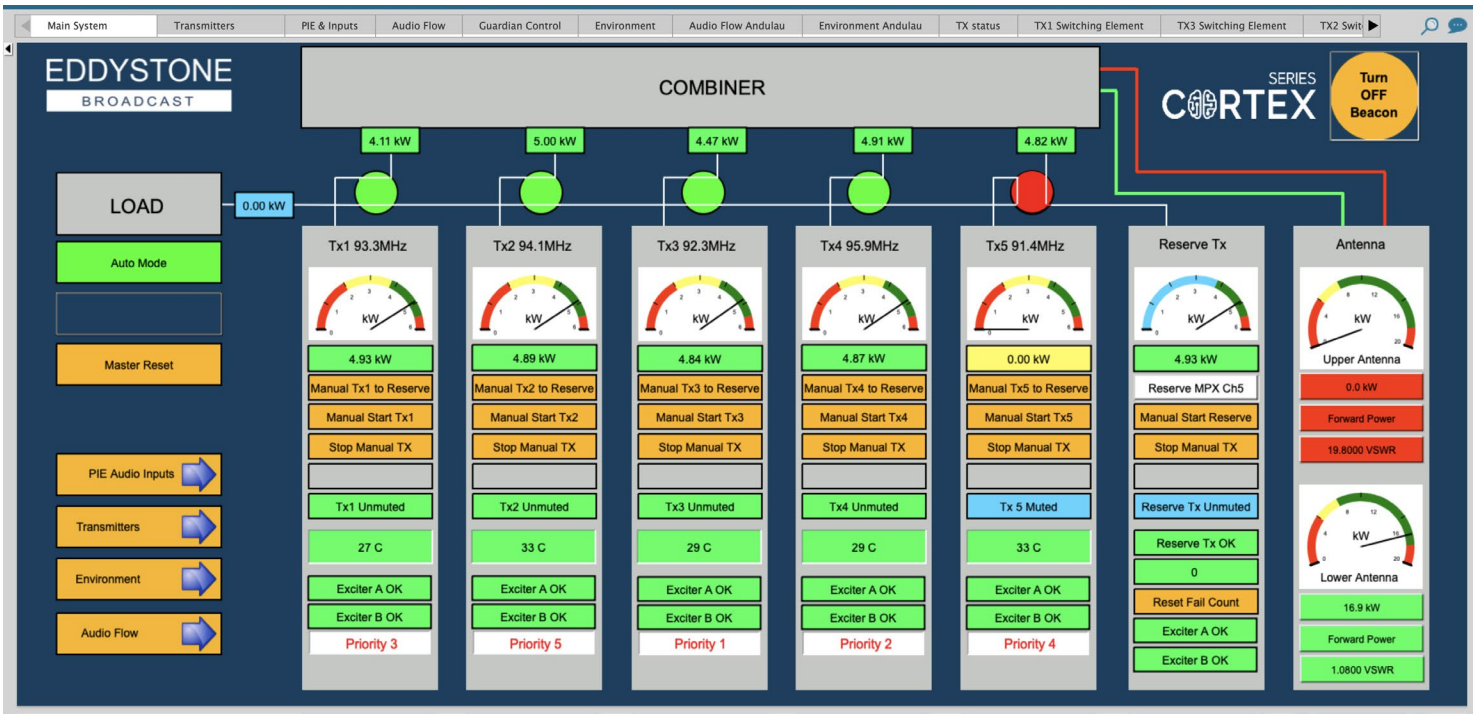

Above Today's remote control systems allow a great deal of customization. The user of this Davicom Cortex360 designed a complete N+1 Controller for a five-transmitter site. It includes the interlock, switching, timing and protection logic to switch the backup transmitter automatically to any one of the main transmitters. Here, TX 5 is off and the backup TX has been switched to the proper frequency, then powered up into the antenna while the defective TX has been switched to the dummy load.

Remote VT is often not sufficient. We may need to route audio, interact with phone callers or operate studio equipment with the studios unoccupied. Almost all of the products offered for transmitter site control can be adapted to handle studio tasks. Many studio systems have built-in interfaces for extensive remote control. A broadcast operations continuity plan should use them, albeit provided we get some cooperation from the IT department.

The modern radio "studio" is not the same concept of 18 or so years ago. Audio over IP is the name of the game — indeed it has changed the game. The modern studio facility is really an audio data center, with all that the concept of a data center entails. All the heavy metal has moved out of the studio. The machines are often not in studio furniture, they are housed in racks in a tech center that requires proper cooling, conditioned power, structured wiring, fire detection/suppression and managed networks. They are operated remotely, from down the hall or across the globe. Sometimes the equipment itself is across the globe in a "cloud-centric" circumstance.

The studio itself is often now just an elaborate workstation, not the tech focus it once was. Many "studio" systems have developed their own remote-control hierarchy, to which the transmitter-oriented systems may be adopted. Nautel transmitters offer direct connection to several digital and AoIP technologies with storage and scheduling of playback content available. Facility monitoring products intended for data centers can be a useful monitoring platform for studio tech centers.

CONNECTIVITY CONCERNS

In a recent Radio World ebook we discussed MPX in the modern age. We noted that the connection from studio to transmitter has evolved significantly in the last few years, and we discussed concerns around that evolution.

All that we said there about connecting for content delivery applies to connecting for monitoring and control as well.

A site now has more ways to connect for M&C, but such may be limited by bandwidth and cost-of-use constraints. Peter Burk stresses the concern that while audio over IP networking may be the reason for the IP protocol to be extended from studio to transmitter site, the AoIP network and file sharing networks are probably not best suited for remote control. Connecting via the house or enterprise network may expose critical systems to the wide unknowns of the open internet. His advice is that remote-control networks should be their own VLAN, preferably a separate switch and path, and not be directly connected to the outside world — which means in practice that not every device on the remote-control network, such as sensors, has to have a Gateway and DNS, only the device that must access the internet.

A device with multiple NICs running software to bridge from the control system to the outside world may be necessary. This is because, in addition to the obvious concerns of cybersecurity, you do not want the time-sensitive control information to be subjected to delay of an A/V prioritized network or large audio and video file transfers.

This author is aware of a situation where the security contractor added four cameras at each of three

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Below
Alex Hanson, ICC specialist for Minnesota Public Radio/American Public Radio, built custom views in his Burk AutoPilot system to help MPR's master control monitor its large station network. Map view visualizes two dozen sites. Each location is tied to site alarm status. Red indicates an active alarm at the site. A user can click a city name to browse to the site page. Hanson included meters and other statuses for MPR's large stations in the Twin Cities, a way to see which audio path is on-air for its national services that are sent to NPR in Washington and a graph to watch the signal on its downlinks. Custom views can also be used for burglar and door alarms.

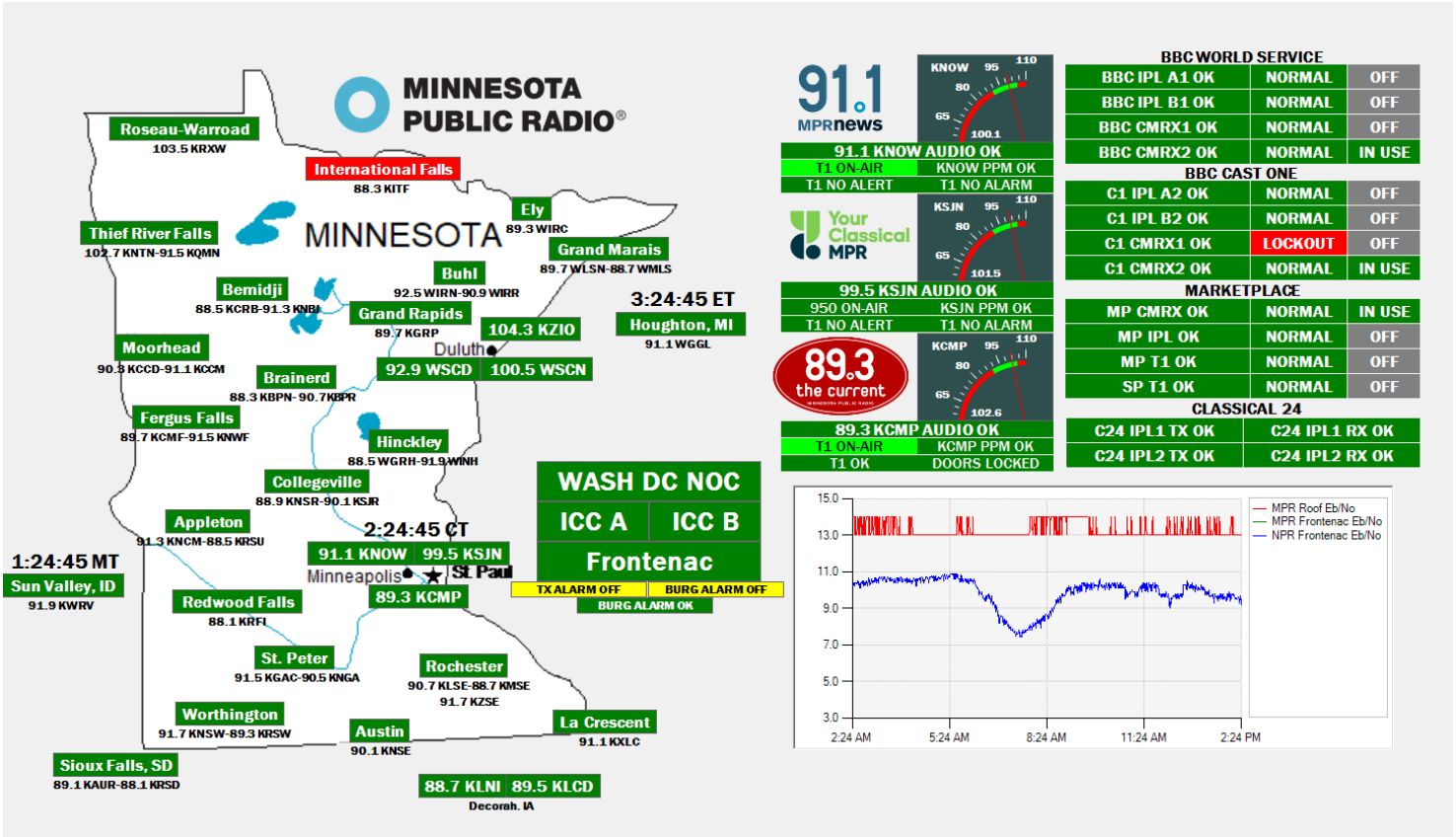
transmitter sites, all connected back to the studio on the same multi-hop 5.8 GHz link. At the studios, multiple PCs were looking at those cameras, with each camera generating a stream per connection. Audio stuttering became a problem and the AM site wouldn't change power reliably. Seems the security contractor had asked IT to change the priority settings when the video was being broken up, at the expense of former prioritized audio and control.

Peter Burk said the preferred approach, adopted in his products, is to build an "island of reliability." Typically this is a central hardware device, located at the transmitter site, to which all other devices connect.

The device provides two primary functions. First, it is configured to provide some degree of local (usually automatic) control and logging of site parameters. Constant and rapid acquisition of data from connected devices is bandwidth-intensive, so local collection is preferred. Data security best practices include use of wired connections and disabling WiFi on remote-control devices to use only when necessary, using high-quality network switches, use of hardware firewalls and VPN use of multiple layers of access to view and control. Local data should also be gathered regardless of outside connections.

Second, assuming there are outside connections, the device can provide a desired set of information to designated parties based upon some level of escalation, thus reducing bandwidth while enhancing communication. The intent here is provide reliable communications, so that monitoring and control are possible under most circumstances, including backup communications circuits.

Controlling the flow of useful information can allow for "faster diagnostics under reduced staff" where consolidation of information allows a single operator to view data of many sites at one time. This is already common in the IT world, with products such as Solar Winds monitoring many servers of different manufacturers and systems on a common monitor. Using IP and SNMP can significantly reduce the wiring required vs traditional GPIO. Using SNMP can also enhance the amount of information available to the central device and enhance its ability to report and control. Software tools may be used to analyze data to achieve various efficiencies and improve troubleshooting. Comparisons between temperature sensors could indicate when air filters need cleaning, rather than simply replacing filters at less-than-optimum times and resource utilization. Comparisons between power output, supply voltage and time of day may indicate when the utility is having trouble meeting your load and provide you with a data output to present to the utility for remediation.



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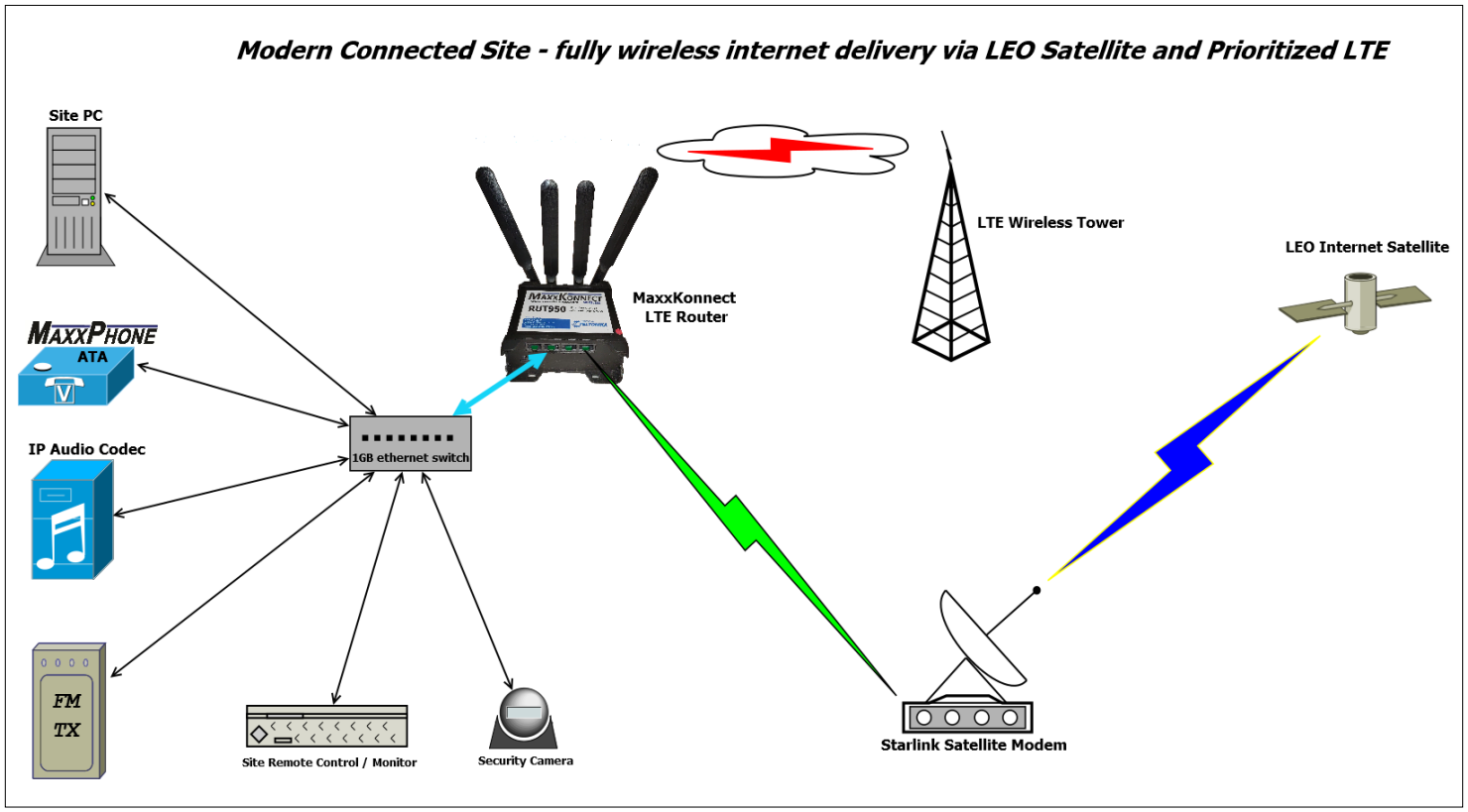

Above
A modern connected site: wireless internet delivery via LEO satellite and Prioritized LTE. The image is from MaxxKonnect.

WHO SHOULD KNOW WHAT?

Nautel's Jeff Welton, known to readers for his tips about site maintenance — "keep it clean, cool and well grounded" — expanded on the capabilities of modern remote systems, beyond just controlling the transmitter.

"It's going to become more critical to determine how to best manage control and monitoring, as well as how to set up notification systems," he said.

"One good example would be with our AUI, where I can set different levels of notification threshold. For example, I can send all audio-related alarms (loss of modulation or the like) to a program director, whereas RF-related or power supply-related alarms could go to the engineer. So you end up defining alarm configuration based more on who should know about what, as opposed to simply deciding what alarms get sent to the collective."

He continued, "A lot of gear serves double duty. For example, we've got the ability in our systems to do rudimentary site control. I could set up an 'over-temp' status where I monitor temperature alarms and use those to activate auxiliary cooling. Or I might use a generator status output to trip a low-power preset in a transmitter."

Jeff noted that because of the fail-safe requirement and the abundance of cost-effective options, "It's a good idea to consider a backup path for remote control."

One such product for primary and backup connection is the MaxxKonnect by the MaxxKonnect Group, a service of Bohn Broadcast.

"It's not so much a challenge to monitor in a modern studio," said President and Chief Engineer Josh Bohn. "We are more unattended now than we have ever been."

MaxxKonnect combines some COTS technologies for IP connectivity with a subscription for data prioritization that provides an enhanced reliability of connection using cellular networks. This provides the ability to have IP connectivity at sites that may not otherwise have access via wired or private wireless. Even if such primary connectivity is available, the MaxxKonnect provides redundancy.

By having the product at studio and transmitter sites, an account can take advantage of IP bandwidth pools to have the services where and when required as needs change. Recent additions to the product allow for streaming audio (backup to STL) and POTS over VoIP, allowing for dial-in access to legacy remote controls. This may be important to some come August 2022.

Most of the vendors consulted for this article expressed a similar sentiment: that the emergence of IP connectivity has meant products becoming more agnostic in regards to what they connect to and between. The issue has become having sufficient processing power in the centralized system, sufficient definition of the purposes of devices and the simplicity or complexity necessary in the connecting networks and the user interface.

But what about facilities with limited ability to interface?

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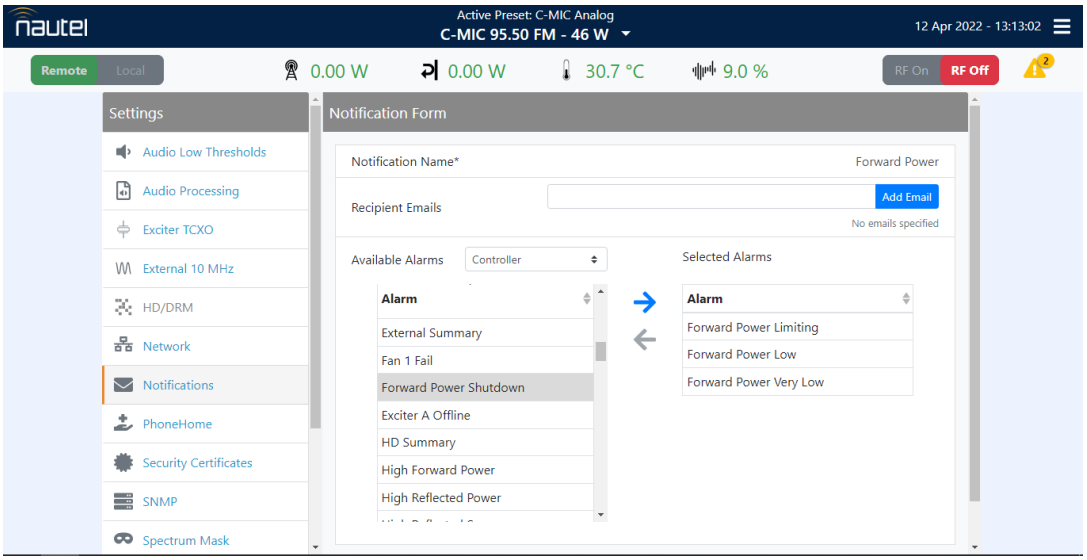


Above
Setting up remote notifications using Nautel's Advanced User Interface (AUI).

As we have noted, remote control often requires monitoring first. Not every product comes with an Ethernet jack or GPIO. Sometimes it is necessary to adapt existing gear to have a remote-capable device. Or a project may require the vendor to provide a device that is ready for connection to a control system, even if the manufacturer does not make such remote devices themselves.

While transmitters may have remote power indication, what does one do in a combined plant, where multiple transmitters, often of different manufacture, may be combined into one system?

Shively Labs, provider of antennas and combining systems, has partnered with TJH Systems of Australia to provide a variety of sensors that can adapt existing transmission line measurement components for use with remote controls. These include power and temperature sensors, a coaxial switch interface, controllers and monitoring devices.

Jonathan Clark of JRClark Solutions, representing Shively and TJH, noted that these interfaces allow companies that may not be on the bleeding edge of technology to convert analog samples to digital "at the source" and broadcasters can use that signal to talk to any manufacturer's gear using open source protocols.

Trevor Harwood, managing director of TJH Systems, noted a particular use case for their new JASMOS Dual RF Power Sensor.

The device connects to several makes and models of sample line sections, and provides a data output, over a single cable (Ethernet or serial), that can be powered by PoE. This allows individual stations in a combiner room to have port data at the combiner brought back to their demised space, on a single cable, without asking for power or locating equipment otherwise in a room that may not accommodate such support easily.

Doing all of this, however, requires careful documentation. Jeff Welton stressed the point repeatedly in our discussion.

"Documentation, especially in the software-controlled domain, is probably as critical as ever — possibly more so, as the level of configuration provided today means that every system will be somewhat unique."

WHAT ABOUT THE SOFTWARE?

John Ahern, CEO of manufacturer Davicom, which began producing remote monitoring and control systems in the mid-1990s, provided several examples of using software with the capability to "auto-control/configure itself to change its behavior on the fly."

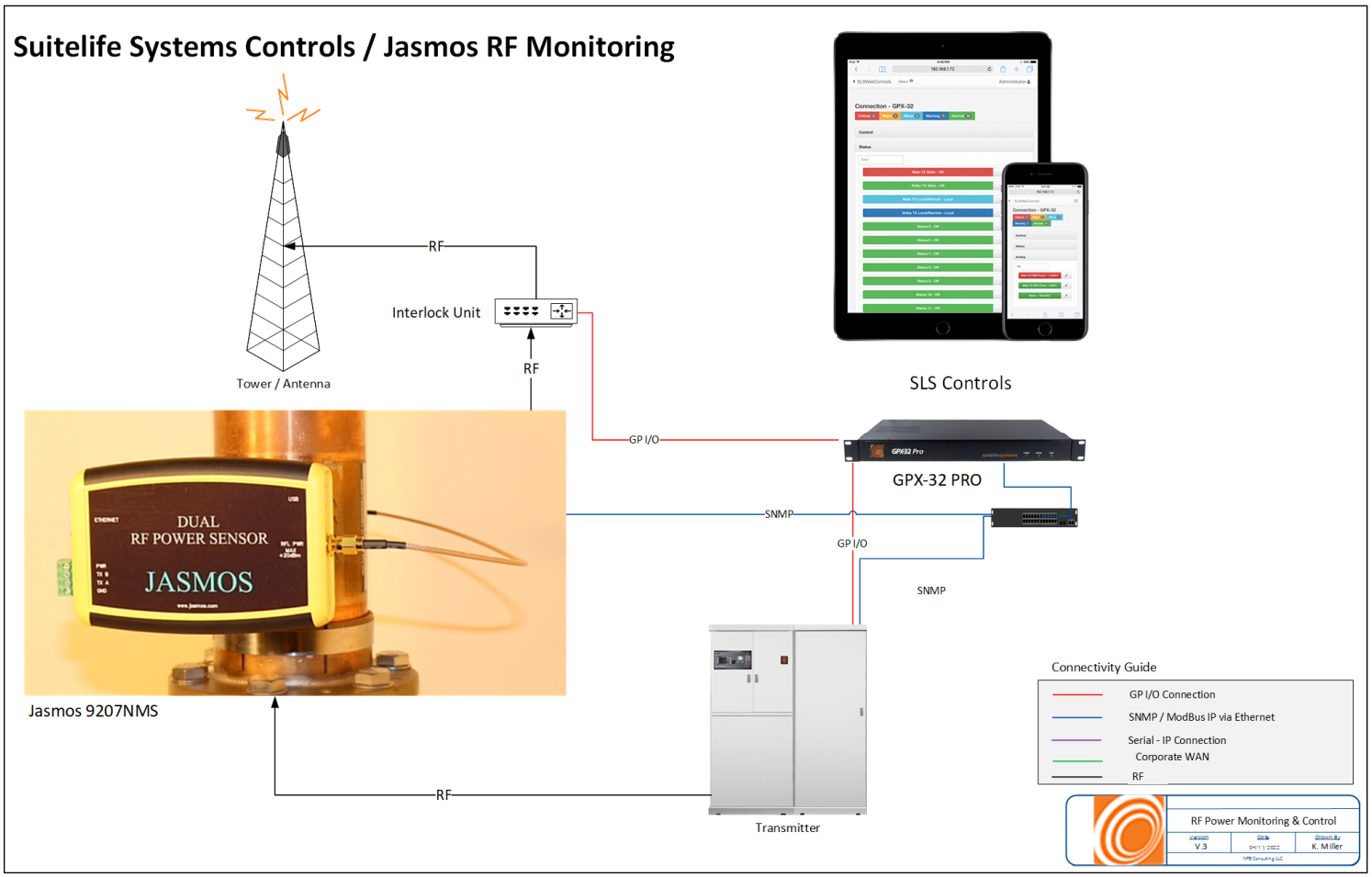
Ahern said the systems could be aware of alarms occurring in proximity to each other or repeating over time and adjust the further responses such as how alarm notifications are sent. Network monitoring tools and SNMP tools could allow detection of flakey networked devices and then cause them to be restarted or reconfigured in some fashion. Such a capability could find use at both studio and transmitter sites.

Davicom offers a rather wide variety of peripherals to monitor almost every device at a site beyond just the transmitter and to do so with SNMP as well. One such product is their DTPI or Davicom Temperature Probe Interface, which integrates up to four temp probes with a local readout at the interface and an on-board SNMP agent.

Peter Burk used the phrase "you only want to alarm what you can control," which argues for the use of broadcast-oriented software, not general-purpose SNMP or screen-sharing apps that may take up bandwidth needed for low-latency monitoring and control. Notice how Peter tied monitoring and control together. The monitoring and alarms may be one device, but a site may have multiple control points that one has to access.

Ahern and Burk both noted the need to reduce unwanted or nuisance alarms and differentiate information between what is an emergency vs something that can wait until the next visit. Several of our sources stressed the need for multiple levels of system access, with an ability to choose who can view vs. who can control.

Burk also noted that products with an API (Application Programming Interface) can allow for the creation of custom programs and integration with other programs, even if the manufacturer's own control software is not



Above
A JASMOS Dual Power Sensor from TJH Systems is deployed as part of an antenna and transmission monitoring system from SuiteLife Systems and Shively Labs.

being used. This is typically done for systems where the product of one vendor is embedded in the product of another vendor.

WHAT ABOUT ACCESS?

We mentioned that M&C is often about configuration and access, and much of our discussion has concerned the former.

For access, custom programs are not always required and may not be readily supported across competing platforms. The rise of smartphones and apps, tablets and HTML5 have expanded greatly the methods by which control may be achieved remotely, on almost any platform. Transmitters and automation products now offer considerable secure functionality over consumer media.

Burk's Arcadia is a cloud-hosted customizable service for your interfaces that tailors the monitoring and control to the interface being used. Nautel and Davicom both offer remote access to monitoring and control via smart phones and tablets. The deprecation of Adobe Flash has been a driving force behind the migration to HTML5 and the opportunities to use commonly available products with browser or apps that allow faster and cheaper configurable access across platforms. All of the major remote controls have features to accommodate remote access across multiple, often portable, devices and platforms.

It is now necessary to carefully determine what devices at the site need to report alarms, which may be through the island of reliability, and which devices need to be accessed for control or added diagnostics. Are the network switch and firewall at your transmitter site sufficient? You might have your modulation monitor trigger a hard closure if there is silence or loss of carrier. That is the outbound or monitoring concern. However, if you modulation monitor is network-capable, it needs a port on the switch and rule in the firewall, so that a person with proper permissions can access the modulation monitor as well. Perhaps you have a common site for several stations and one remotely accessed modulation monitor to check on carrier, stereo pilot, RDS and other performance concerns.

WHAT IS AHEAD?

As systems evolve, remote-control concerns coming into view may include choosing between cloud or on-premises hosting, managing control as an operating vs. capital expense, and the use of AES70 for control.

This is made possible in part because IP networks,

SNMP and similar technologies rely upon standardization of communication. Cabling, connectors, protocols, all are ubiquitous and preferably agnostic to the devices being controlled. Opportunities arise for new products such as the TJH JASMOS that use the common protocols to facilitate communication between dissimilar devices that originally were meant to be networked. Once it's all on the network, it's "Just A Simple Matter Of Software" — which how JASMOS got its name.

Burk recently released its ARC Now customization service, which allows for complete systems to be delivered that are programmed prior to delivery for the site-specific parameters. This is intended to allow engineers and managers to use the resources of the manufacturer in providing a product that is as close as possible to plug-n-play for detailed configuration, reducing the time and resources requirements necessary to getting the installation completed.

ARC Now means a system can be "ready to run with controls, alarms, logging, reports, Jet Active Flowcharts and AutoPilot custom views," according to a Burk press release. The service is available to new and existing users of its ARC Plus line.

LOGOUT

Having opened this article with a login, we will close with a logout, because it is a best practice to always log out when done with Monitoring and Control!

M&C today may mean more devices to be monitored, more devices to be controlled, more information to be managed, more parties to be alerted or allowed access across more sites.

But the good news is that "remote control" no longer has to be one box that you try to make work. Remote control systems have evolved to use common communication methods for tailoring your M&C to your needs, with possibly much less wiring and yet redundant options.

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